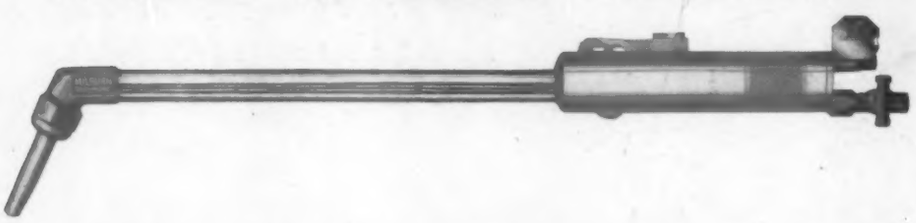
The Welding Engineer

Founded by L. B. Mackenzie, 1916

FEBRUARY, 1927 VOL. 12, No. 2

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. Reg. U. S. Pat. Office $4.00 per year abroad

THE MILBURN CUT-WELD TORCH



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Tips *is* profitable

MANY kinds of tips *are* profitable. But the kind of Tips we speak of *is* profitable. We mean Oxy-Acetylene Tips.

Tips is a magazine published for the past five years by Linde for welders, engineers and production men who have anything to do with welding.

It contains the news of the oxy-acetylene process—new developments, new methods, new applications. It discusses the common, everyday jobs that welders have to do.

Edited by a staff that is in touch with welding and cutting developments in every industry, it is an invaluable guide for those who use the oxy-acetylene process.

"Tips" is a dynamic part of Linde service and is sent free to Linde users.

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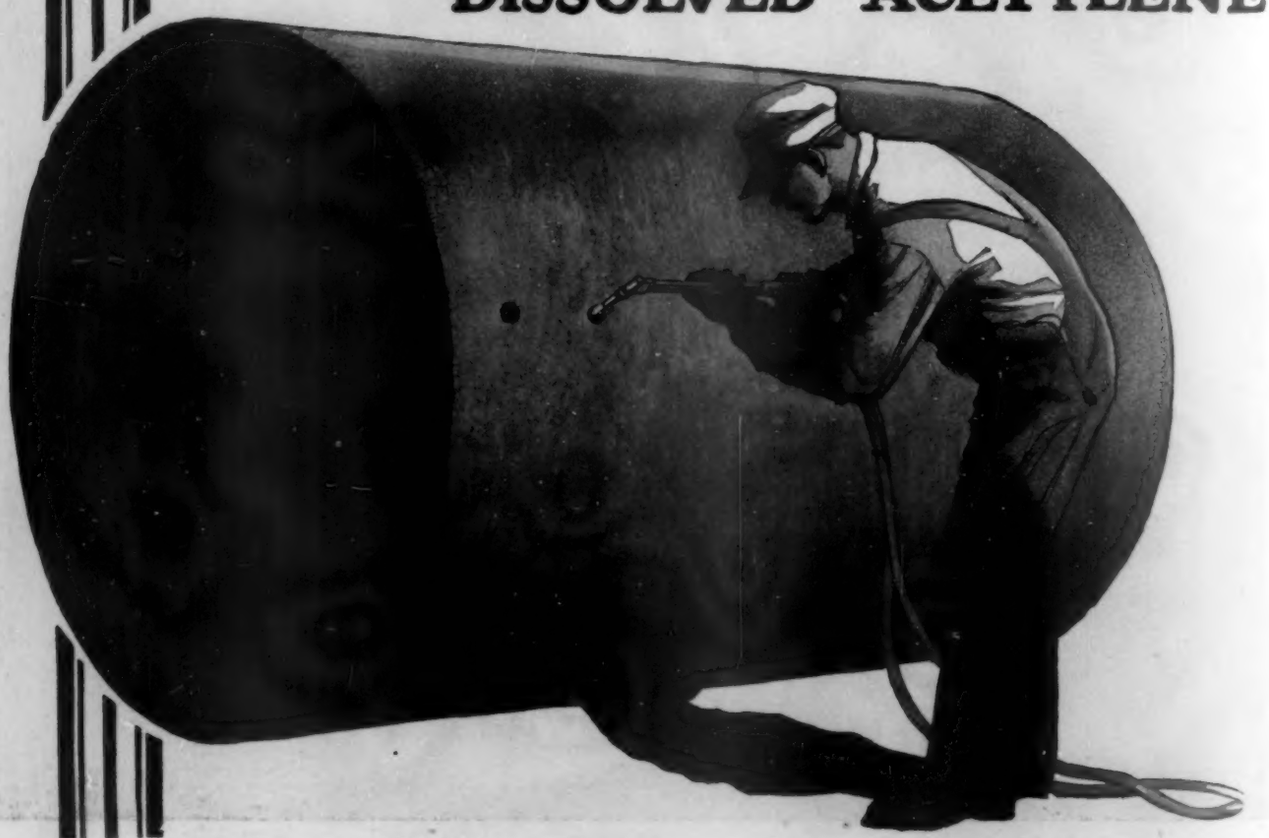

The Welding Engineer

Founded by L. B. Mackenzie, 1916

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Progress and Publicity

YOU are often impressed by stories of accomplishment in welding which first come to light in the advertising pages of your business paper, and perhaps wonder why such significant information is published first in paid space. The answer is simple enough. New processes, involving the solution of problems in the impossible class, usually are the result of long and expensive research or experiment. The manufacturer who is responsible for such development work naturally wants to be credited for it. So he keeps his counsel until he is ready to publish an announcement worded to his own ideas and giving his own organization full credit for its contribution toward the progress of the art and the industry. Advertising is a dignified and effective way to do this. The principle does not apply to every new process, or every new application of a process, but when it does apply it produces advertising copy that sets the tongues a-wagging. Furthermore, the paid space furnishes a way to keep the public reminded of new developments after published stories cease to have real news value. This educational quality in business paper advertising is typical of the modern business paper.

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Eastern Office—222 American Circle Bldg., New York
T. E. DePew, Eastern Manager
Telephone, Columbus 6941

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L. St. Clair Ehlbert, Cleveland Manager

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Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
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Westinghouse Elec. & Mfg. Co.

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ASBESTOS INSULATED WIRE AND CABLE
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See "Torches."

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Oxweld Acetylene Co.
Torchweld Equipment Co.
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Central Steel & Wire Co.
Steel Sales Corp.

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N. A. Strand & Co.
Wodack Electric Tool Corp.

BUTT WELDERS
See "Electric Resistance Welders"

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Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
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Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
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Shawinigan Products Corp.
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Harris Calorific Co.
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Oxweld Acetylene Co.

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Milburn, Alexander Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

CAST IRON SOLDER
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CONSULTING ENGINEER
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Westinghouse Elec. & Mfg. Co.
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CYLINDERS (Oxygen, Hydrogen)
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See "Cutting Electrodes"

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Wickwire-Spencer
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Electric Welding Machine Co.
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General Electric Co.
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Waters Arc Welding Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

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Oxweld Acetylene Co.
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Imperial Brass Mfg. Co.
Lincoln Steel Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Steel Sales Corp.
Stulz-Sickles Co.
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Torchweld Equipment Co.
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FLUE WELDERS (Electric)
General Electric Co.

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Central Steel & Wire Co.
Cortland Welding Compound Co.
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Torchweld Equipment Co.
Weldene Corporation
Weldit Acetylene Co.

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U. S. Welding Co.
Weldit Acetylene Co.

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M. Keith Dunham
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Milburn, Alexander Co.
Oxweld Acetylene Co.
U. S. Welding Co.

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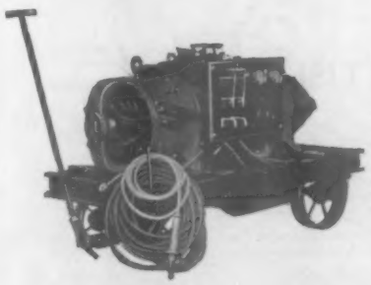
Ideal Face Shield Co.
Strauss & Buegeleisen
Willson Goggles, Inc.

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
Mall Tool Co.
N. A. Strand & Co.
Wodack Electric Tool Corp.

"Say, we need some more of this Wilson Rod!"



The above is a Wilson Type S Single-Operator Motor-Driven Electric Welding Machine—designed for both production and repair work, and adapted for use wherever power is available. Its capacity is 25 to 300 amperes. Other Type S Machines include both single and two-operator units—gasoline-engine-driven, belt-driven and motor-driven—portable and stationary. Capacities: 25 to 250 Amps. 25 to 300 Amps. 25 to 600 Amps.

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Torchweld Equipment Co.
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See "Fire Proof Plastic Material"

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Metal & Thermit Corp.

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RAIL JOINT WELDERS
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Torchweld Equipment Co.
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Weldit Acetylene Co.
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SEAM WELDERS
See "Electric Resistance Welders"

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
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Metal & Thermit Corp.

TORCHES (Welding and Cutting)
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Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
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Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

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Harris Calorific Co.
Joseph Dixon Crucible Co.
National Carbon Co.

WELDING ROD HOLDERS
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ALWAYS PACKED IN BLUE AND GRAY DRUMS

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3½ in. x 2" in. (Lump)
2 in. x ½ in. (Egg)
1¼ in. x ⅜ in. (Nut)
¼ in. x 1/12 in. (Quarter)

For Oxy-Acetylene Welding and Cutting Plants, Acetylene House Lighting and Cooking Plants, Contractors' Torches and Flare Lights, and numerous other pieces of Acetylene generating apparatus designed for the use of one of these sizes of Carbide.

UNION CARBIDE SALES COMPANY

Peoples Gas Building
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Carbide and Carbon Building
30 East 42nd St.
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Shipments Always Made On Day Orders Are Received

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Ft. Smith....201 Rogers Ave.
Little Rock....1400 E. 6th St.

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Los Angeles....639 Gibbon St.
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Peoria....100-110 Edmund St.
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Rockford....220 Prairie St.
Springfield....1000 E. Monroe St.
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South Bend....413 East Tutt St.
Terre Haute....541 N. Fifth St.

IOWA
Davenport....118 Harrison St.
Des Moines....Third and Elm Sts.
Dubuque....Eighth and Washington Sts.
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Sioux City....410 Court St., P. O. Box 398
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Pittsburg....1201 North Broadway
Salina....154 N. Fifth St.
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Hazard....107 Main St.
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Louisville....Jackson St. and River Rd.
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Cumberland....18 N. George St., P. O. Box 172
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Indian Orchard....Pasco Road
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Grand Rapids....435-459 Ionia Ave., S. W.
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Iron River....321 Carnegie Ave., P. O. Box 357
Ironwood....232 W. Ayer St.
Ishpeming....511 E. Vine St.
Jackson....518 S. Water St.
Lansing....617 E. Shiawasee St.
Muskegon....410-420 Morris Ave.
Saginaw....1830-1840 N. Michigan Ave.
Sault Ste. Marie....

MINNESOTA
Mankato....402-404 Pike St.
Minneapolis....324 N. First St.
Virginia....403 Chestnut St.

MISSISSIPPI
Vicksburg....1701-03 Levee St., P. O. Box 322

MISSOURI
Kansas City....1427 West 9th St.
St. Joseph....920 S. Sixth St.
St. Louis....(See East St. Louis, Ill.)

MONTANA
Great Falls...(P. O. Box 1188) 420 Second St. S.

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Grand Island....311 West 4th St.
Omaha....1007-9-11 Jones St.

NEW JERSEY
Camden....Front and Division Sts.
Newark....251-55 Ridgewood Ave.

NEW YORK
Albany....Mill and Tivoli Sts.
Binghamton....100 Roundhouse Road
Brooklyn....1085 Grand St.
Buffalo....1345 Genesee St.
Geneva....261 Exchange St.
Jamestown....610 W. 8th St.
Kingston....O'Neil St., Near Broadway
Niagara Falls....
Poughkeepsie....Smith St. and C. N. E. R. R.
Syracuse....376 W. Water St.
Utica....135 Hotel St.
Watertown....438 Court St.
Whitehall....35 Main St.

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Charlotte....205 W. First St., P. O. Box 777
Greensboro....Macon & Washington Sts
Raleigh..McCullough & Lenoir Sts., P. O. Box 149
Wilmington, 612 Surry St., Bet. Castle and Queen Sts.
Wilson....700 S. Goldsboro St., P. O. Box 516

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Bismark....
Fargo....414 N. P. Ave.

OHIO
Akron....97 East South St.
Athens....Corner Factory and Moore Sts.

Canton....618 Mulberry Road, S. E.
Cincinnati....67 Plum St.
Cleveland....1242 Hanna Bldg.
Columbus....330 Dublin Ave.
Dayton....104-114 S. Wayne Ave.
Gallipolis....700 First Ave.
Lima....338 E. High St.
Mansfield....131 E. Fifth St.
Steubenville....324-342 N. Seventh St.
Toledo....414 S. Erie St.
Youngstown....Jones and Brittain Sts.
Zanesville....Main and Second Sts.

OKLAHOMA
Enid....Chestnut and Adams Sts.
McAlester....31-37 East Chickasaw St.
Oklahoma City....121 E. Washington St.
West Tulsa....1402 W. 17th St.

OREGON
Portland....15th and Hoyt Sts.

PENNSYLVANIA
Allentown....311 Gordon St.
Beaver....486 Third St.
DuBois....Weber Ave. and Franklin St.
East Greensburg....Clark and George Sts.
Erie....1502 Sassafras St.
Harrisburg....25 S. Tenth St.
Hazleton....223 E. Mine St.
Johnstown....Messinger St. and B. & O. R. R.
Philadelphia....Delaware Ave. and Brown St.
Philipsburg....North Front St., P. O. Box 146
Pittsburgh....Lincoln & Tabor Sts.
Pottsville....Railroad and Sanderson St.
Scranton....Penn Ave. and Vine St.
Shamokin....Fifth and Walnut Sts.
Sharon....Budd St. and South Irvine Ave.
Spangler....Bigler Ave.
Wilkes-Barre....150-156 E. Northampton St.
Williamsport....Canal and Court Sts.
York....204 N. George St.

SOUTH CAROLINA
Charleston....59 Wentworth St.
Greenville....15 McBee Ave.

SOUTH DAKOTA
Watertown....224 First Ave., N. W.

TENNESSEE
Chattanooga....600 E. Tenth St.
Knoxville....201-211 Randolph St., P. O. Box 1431
Memphis....671 S. Main St.
Nashville....102-104-108 Broadway

TEXAS
Amarillo....101-105 Pierce St., P. O. Box 697
Beaumont....386 Liberty St.
Dallas....1118-28 Jackson St.
El Paso....317 N. Oregon St.
Fort Worth....1111 Lamar St.
Houston....812 Live Oak St.
San Antonio....Duvall and Mesquite Sts.
Sweetwater....117 E. North First St.
Waco....315 S. Thirteenth St.
Wichita Falls....1507 Lamar St., P. O. Box 1713

UTAH
Salt Lake City....108 W. Second South St.

VIRGINIA
Lynchburg....1224 Commerce St.
Norfolk....120 W. Plume St.
Richmond....17th and East Cary Sts.

WASHINGTON
Seattle....304 Railroad Ave., S.
Spokane....162 S. Post St.

WEST VIRGINIA
Bluefield....350 Roanoke St.
Charleston....Broad St. and K. & M. R. R.
Clarksburg....608 North Third St.
Elkins....Railroad Ave and First St.
Fairmont....Auburn St. and B. & O. R. R.
Huntington....207 Eleventh St.
Morgantown....Warren St., near University Ave.
Mount Hope....P. O. Box 416
Mullens....P. O. Box 37
Wheeling....Forty-third and McCulloch Sts.
Williamson....Foot W. Second St., P. O. Box 305

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Appleton....909 N. Lawe St.
La Crosse....Front and King Sts.
Madison....513-19 Williamson St.
Marshfield....South Depot and Maple Sts.
Milwaukee....619 33rd Ave.

WYOMING
Casper....218-24 Industrial Ave.

UNION CARBIDE IS EASILY OBTAINABLE EVERYWHERE

Buy Oxygen at Home!

Patronize Local Industries. Aid in the support and prosperity of your own community. Get quicker service—with courteous attention. And above all *secure high purity oxygen*—when you need it and as you need it. The plants of the Gas Products Association listed below offer you all of these advantages. Why not accept them?

99 Plants and Warehouses; One Is Near You

ALABAMA
†*Birmingham—Burdett Oxygen Co.
Birmingham — Standard Gas Products Co. of Alabama.
*Mobile—Louisiana Oxygen Co.

CALIFORNIA
†*Fresno—California Compressed Gas Co.
†Los Angeles—California Compressed Gas Co.
†Oakland — California Compressed Gas Co.
†*Redding — California Compressed Gas Co.
†*Sacramento—California Compressed Gas Co.
†*San Francisco — California Compressed Gas Co.
†*San Jose — California Compressed Gas Co.
†*Stockton — California Compressed Gas Co.

COLORADO
†Denver—Colorado Compressed Gas Co.

DELAWARE
†Wilmington—Paschall Oxygen Co.

GEORGIA
†Atlanta—Burdett Oxygen Co.

ILLINOIS
†Chicago—Acme Oxygen Co.
†Burdett Oxygen & Hydrogen Co.
†Swift and Company.
*Elgin—Wisconsin Oxygen-Hydrogen Co.
*Freeport—Wisconsin Oxygen-Hydrogen Co.
†Peoria—Electrox Co.
*Rockford—Wisconsin Oxygen-Hydrogen Co.

INDIANA
†*Evansville—Kentucky Oxygen-Hydrogen Co.
†Indianapolis—Indiana Oxygen Co.
Logansport—Logansport Oxygen Co.
†*South Bend—Burdett Oxygen-Hydrogen Co.

IOWA
†Bettendorf — Bettendorf Oxygen-Hydrogen Co.

KENTUCKY
†Louisville—Kentucky Oxygen-Hydrogen Co.

LOUISIANA
New Orleans—Louisiana Oxygen Co.
Shreveport — The Bain-Beaird Co.

*Signifies Warehouses.
†Plants and warehouses indicated can supply Hydrogen.

MARYLAND
†*Baltimore—Southern Oxygen Co.

MASSACHUSETTS
†Everett—New England Compressed Gas Co.

MICHIGAN
†Detroit—Burdett Oxygen Co. of Detroit.
Wall Bros. Co.
*Grand Rapids—Grand Rapids Welding & Supply Co.
Muskegon — Michigan Ox-Hydric Co.

†Minneapolis—Commercial Gas Co.

MISSOURI
†Kansas City — Kansas City Oxygen Gas Co.
†Ox-Hydrogen Mfg. Co.

MONTANA
†Butte—Mountaineers Welders' Supply Co.

NEBRASKA
Omaha—The Balbach Co.

NEVADA
*Reno—California Compressed Gas Co.

NEW JERSEY
†Camden—Paschall Oxygen Co.
†Newark — International Oxygen Co.
†*New Brunswick—International Oxygen Co.
†*Paterson—International Oxygen Co.
†*Plainfield—International Oxygen Co.
†*Trenton — Paschall Oxygen Company.
†*Trenton—International Oxygen Co.

NEW YORK
†*Brooklyn—International Oxygen Co.
†*Long Island — International Oxygen Co.
†*New York—International Oxygen Co.

NORTH CAROLINA
Charlotte—Carolina Standard Gas Products Co.

OHIO
†Canton—Buckeye Oxygen Co.
†Cincinnati—Ohio Valley Oxygen Co.
†Cleveland — Burdett Oxygen Co. of Cleveland.
*Cleveland—Clarke Chemical Co.
Columbus—Gas Products Co.
†Dayton — Dayton Oxygen & Hydrogen Products Co.
†Niles—Ohio Oxygen Co.
†Toledo—International Oxygen Co.
Wickliffe — Clarke Chemical Co.

OKLAHOMA
†Oklahoma City—Burdett Oxygen Co. of Oklahoma City.

OREGON
†*Astoria—Portland Oxygen & Hydrogen Company
†*Bend—Portland Oxygen & Hydrogen Company.
†*Corvallis—Portland Oxygen & Hydrogen Company.
†*Eugene—Portland Oxygen & Hydrogen Company.
†*Klamath Falls—Portland Oxygen & Hydrogen Company.
†*Medford—Portland Oxygen & Hydrogen Company.
†*Pendleton—Portland Oxygen & Hydrogen Company.
†Portland—Portland Oxygen & Hydrogen Co.
†*Roseburg—Portland Oxygen & Hydrogen Company.

PENNSYLVANIA
†*Allentown — Paschall Oxygen Company.
†*Lancaster—Paschall Oxygen Co.
*Philadelphia—Burdett Oxygen Co.
†Philadelphia—Paschall Oxygen Co.
†Pittsburgh—Burdett Oxygen & Hydrogen Co.
†Verona—International Oxygen Co.
†*York—Paschall Oxygen Company.

RHODE ISLAND
*Providence — New England Compressed Gas Co.

TENNESSEE
†Chattanooga—Burdett Oxygen Co.
†*Johnson City—Kentucky Oxygen-Hydrogen Co.
†*Knoxville — Burdett Oxygen Co.
†*Knoxville—Kentucky Oxygen-Hydrogen Co.
Memphis — Memphis Oxygen Co.
†*Nashville — Burdett Oxygen Co.
†*Nashville—Kentucky Oxygen-Hydrogen Co.

TEXAS
Beaumont—Magnolia Gas Products Co.
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Ft. Worth — Burdett Oxygen Co. of Texas.
*Galveston—Gregory Auto Supply Co.
†Houston—Magnolia Gas Products Co.
*Ranger—Burdett Oxygen Co. of Texas.
†*San Antonio — Magnolia Gas Products Co.
*Waco—Burdett Oxygen Co. of Texas.
*Wichita Falls—Burdett Oxygen Co. of Texas.

UTAH
†Salt Lake City—Utah Compressed Gas Co.
†*Ogden—Utah Compressed Gas Co.

VIRGINIA
†*Norfolk— Portsmouth Oxygen Corporation.
†Portsmouth—Portsmouth Oxygen Corporation.

WASHINGTON
†*Bellingham—Washington Compressed Gas Co.
†*Everett — Washington Compressed Gas Co.
†Seattle — Washington Compressed Gas Co.
†*Tacoma — Washington Compressed Gas Co.

WISCONSIN
†*Appleton — Universal Oxygen Co.
*Beloit—Wisconsin Oxygen-Hydrogen Co.
†*Fond du Lac—Universal Oxygen Co.
†*Green Bay—Universal Oxygen Co.
*Janesville—Wisconsin Oxygen-Hydrogen Co.
†Kenosha—Wisconsin Oxygen & Hydrogen Co.
*Lake Geneva—Wisconsin Oxygen-Hydrogen Co.
†*Madison — Universal Oxygen Co.
†*Manitowoc — Universal Oxygen Co.
†Milwaukee—Universal Oxygen Co.
*Oshkosh—Wisconsin Oxygen-Hydrogen Co.
*Racine — Wisconsin Oxygen-Hydrogen Co.
†Sheboygan—Universal Oxygen Co.

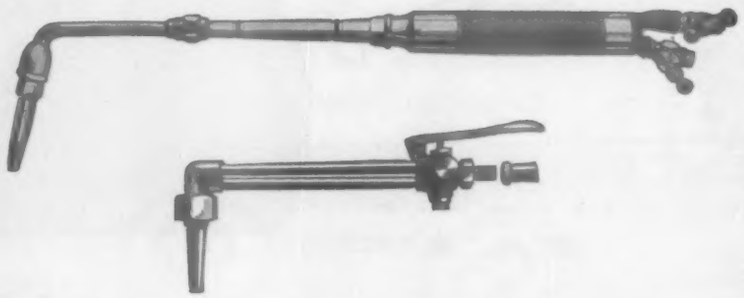
Gas Products Association
140 So. Dearborn St. Chicago, Ill.

First to Advocate High Purity Oxygen

WELDERS

LEAD BURNERS

REGULATORS



SPECIAL BURNERS

TANK VALVES

MANIFOLDS

G M C MODEL No. 2
WELDING TORCH AND CUTTING HEAD

"TRIED AND FOUND NOT WANTING"

One of the most popular combinations ever offered the welding and cutting fraternity.

"The Most Complete Line in America"

GASAVERS

ACETYLENE GENERATORS

COMPLETE OUTFITS

THE HARRIS CALORIFIC COMPANY
2828 Washington Ave., Cleveland, Ohio

With which is now merged the U. S. Welding Co., formerly of Minneapolis, Minn.

GENERATOR OUTFITS

AUTOMATIC TORCHES

CUTTERS

PREHEATERS

Most Boiler and Tank Manufacturers Use G-E Arc Welders

HENRY VOGT MACHINE CO.
INCORPORATED
MANUFACTURERS OF
REFRIGERATING MACHINERY-OIL REFINERY EQUIPMENT
WATER TUBE AND HORIZONTAL TUBULAR BOILERS
DROP FORGED STEEL VALVES AND FITTINGS
GENERAL OFFICES & WORKS 10TH & ORMSBY STREETS
LOUISVILLE, KY., U. S. A
Jan. 5, 1926.

General Electric Co.,
455 So. 4th St.,
Louisville, Ky.

Attention Mr. M. M. Hughes, Sales Agent.

SUBJECT: Arc Welders.

Gentlemen:

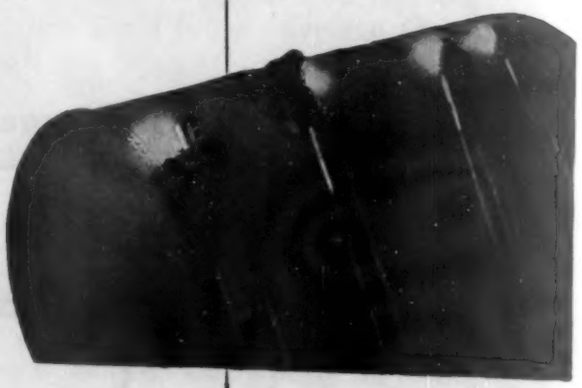
In response to your letter of the 23rd ultimo wish to state, we have been using your arc-welding machines for the past five or six years in welding calking seams on high pressure and high temperature vessels, and have found these machines as regards to operation and the quality of the work performed satisfactory to our customers and ourselves.

You may be further interested in knowing we have considerably cut the cost of our welding operations since we began using your machines.

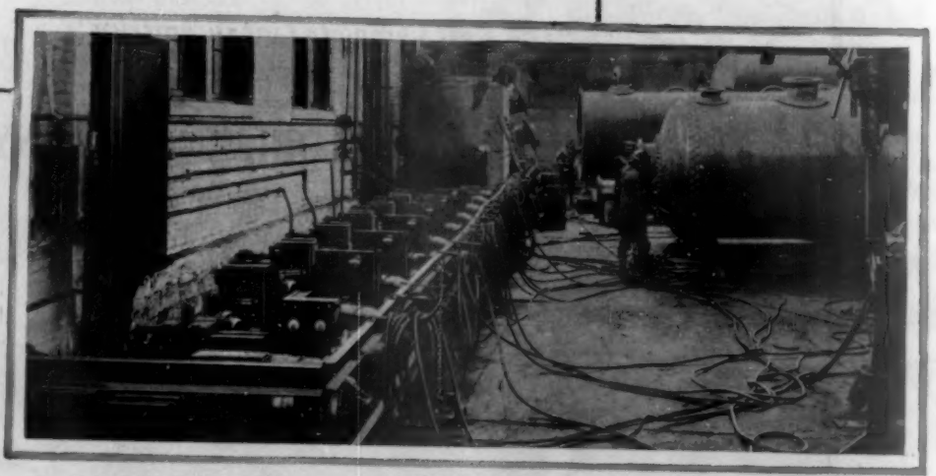
Yours truly,

HENRY VOGT MACHINE CO.
Henry E Vogt
H. E. Vogt,
SUPERINTENDENT.

HEV (HS)



Vogt high pressure and high temperature oil stills—10 ft. diameter 60 ft. long, weight 107,000 pounds. Four welders working from G-E Type WD arc welding sets.



Partial installation of G-E arc welders used for sealing high pressure gasoline stills in plant of Henry Vogt Machine Co., Louisville, Ky.

General Electric furnishes to the Welding Industry:

- WD Arc Welders—designed for one operator
- Constant Potential Sets—for several operators
- Arc Welding Resistors—for mining and traction companies
- Automatic Sets—for repetition work

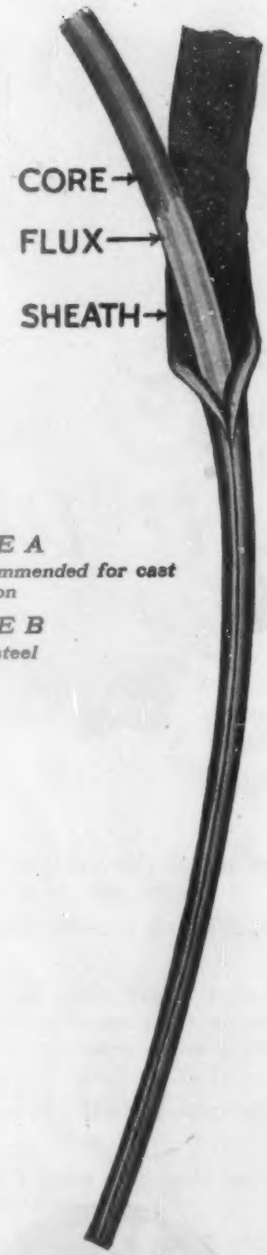
Complete information and bulletins available at your nearest G-E office.

530-16

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Concentrated arc of G-E Welding Electrode speeds steel welding



TYPE A
recommended for cast iron

TYPE B
for steel

Arc stability—the consistent, continuous, concentrated functioning of the arc—this tells the whole story of the success of G-E Welding Electrode. A central metallic core, a coating of flux, and a metallic sheath is the construction which permits greater speed, greater ease in operating and gives a strong, tough weld.

The TYPE B electrode is made especially for steel. It has exceptional flexibility of operation. It operates at the same ease with currents of much higher values than are ordinarily used and with arc voltages up to 50% higher.

Ask the nearest Special Distributor for the Folder "The Concentrated Arc." He will be glad to demonstrate.

Special Distributors for G-E Welding Electrodes

American Steel Eng. Co.,
10 South 18th St.,
Philadelphia, Pa.
also
601 Granite Bldg.,
Pittsburg, Pa.

Bird-Potts Co.,
Adanta, Ga.

Capital Electric Co.,
Salt Lake City, Utah.

Harron, Rickard & McCone,
139 Townsend St.,
San Francisco, Cal.

Robert M. Hartwell,
353 East 2nd St.,
Los Angeles, Cal.

Industrial Sup. Co., Inc.,
329 East Second St.,
Los Angeles, Cal.

Hendrie & Bolthoff Mfg. & Supply Co.,
Denver, Colo.

P. F. McDonald & Co.,
17 King Terminal,
Boston, 27, Mass.

Matthews Electric Sup. Co.,
1823 First Ave.,
Birmingham, Ala.

The C. S. Mersick & Co.,
New Haven, Conn.

National Welding Equip. Co.,
223 Main Street,
San Francisco, Cal.

Root, Neal & Co.,
Buffalo, N. Y.

Joseph T. Ryerson & Son, Inc.
Chicago, Ill.
also
Cincinnati, O.
Detroit, Mich.
St. Louis, Mo.

Seattle Hardware Co.,
Seattle, Wash.

Southern Electric Co.,
Baltimore, Md.
also
Charlotte, N. C.
Norfolk, Va.
Richmond, Va.

Southwest General Elec. Co.,
Dallas, Texas.
also
Houston, Texas.
Oklahoma City, Okla.

Strong, Carlisle & Hammond Co.,
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Union Iron Works,
Spokane, Wash.

Virginian Electric Inc.,
Charleston, W. Va.

A. J. Wilson Co., Inc.,
120 Liberty St.,
New York, N. Y.

W. A. Ramsey, Ltd.,
74 Queen St.,
Honolulu, Hawaii.

Oliver H. Van Horn Co., Inc.,
522-534 Camp Street,
New Orleans, La.

Welding Service Co.,
50 Church Street,
New York, N. Y.

In absolute reliability of operation and overall efficiency, there is no superior to G-E Arc Welders. They are available in all sizes, all types—for either hand or automatic operation—for single or multiple-operator.

550-6

GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

NAT WELD

MOTOCO

In union there is Service

The Moto Meter Company, Inc., makers of the famous Boyce Moto Meter and of indicating thermometers for industrial uses, announces the purchase of The National Gauge & Equipment Company, makers of gauges, ammeters, thermometers, etc.

The latter company will hereafter be operated as The National Gauge & Equipment Division of The Moto Meter Company, Inc.

The net effect of this consolidation increases the value of both companies to customers. To National Gauge resources have been added the fine engineering abilities of Motoco; and to Motoco have been added the exceptional manufacturing experience of National Gauge, plus a series of instruments which will round out very completely the present line of industrial equipment.

Together, these two internationally respected parts of a single ably directed and well-financed corporate body are prepared to render you exceptional service.

The Moto Meter Company, Inc.
Wilbur Avenue, Long Island City, N. Y.

National Gauge & Equipment Div., La Crosse, Wisc.
Chicago Office—820 Tower Court
The Moto Meter Co. of Canada, Ltd., Hamilton, Ont.

Pop thought all welding machines were alike

"Here Lad...

you promised me that arc welding would bring to our plant a boost in production that would enable our men and our company to make money.

"You tricked us, because you can't show us any more money made."

Kathode wire is furnished in the following diameters: 3/32", 1/8", 5/32", 3/16", 1/4", 5/16", 3/8".

Lincoln Shields are absolutely leak-proof.

Here is a holder that will save many minutes of the operator's time. It is a simple, powerful clamp in which the electrode is firmly held.

"No Pop...

it can't be done because you haven't the money in your mit—but it's coming in this way:

"First you've learned that you can do a BETTER job by arc welding.

"And second, you've found out a highly important thing—and this is it: You haven't the right machine to get the speed that makes more profit for both you and the men.

"But I didn't trick you—you tricked yourself and the men.

"The production figures I gave you were based on the Lincoln Stable-Arc Welder.

"Then you hopped out and handed the order to your old crony who sells 'just another welder.'

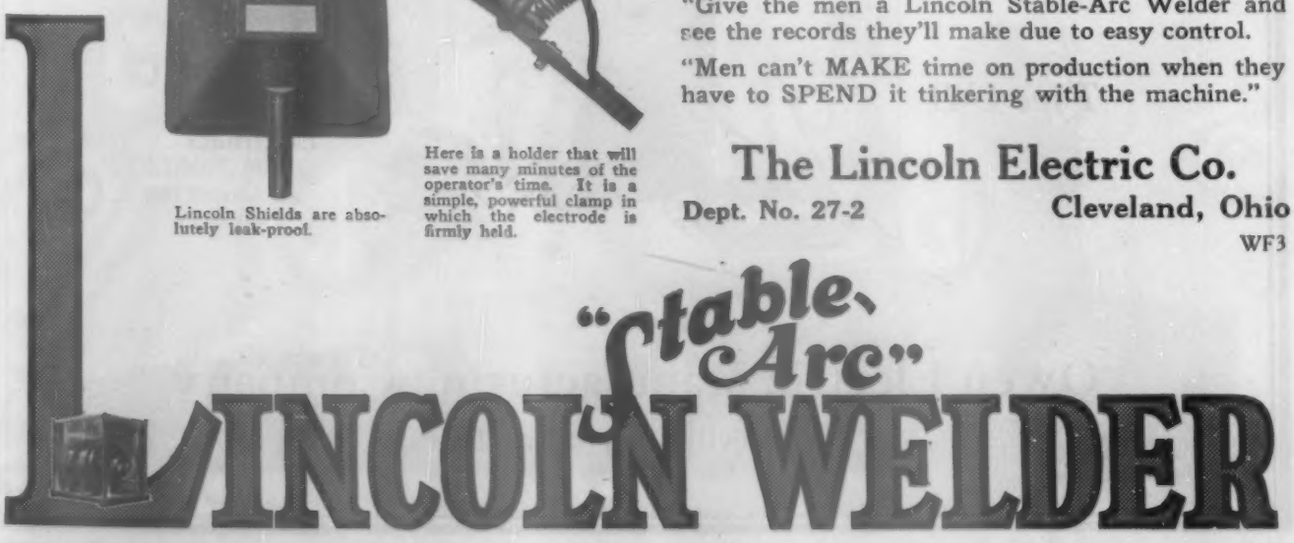
"Give the men a Lincoln Stable-Arc Welder and see the records they'll make due to easy control.

"Men can't MAKE time on production when they have to SPEND it tinkering with the machine."

The Lincoln Electric Co.

Dept. No. 27-2 **Cleveland, Ohio**

WF3



Manufacturers, Machine Shops, Boiler Works, Garages,

and other Industrial Plants, are obtaining excellent results with the

OWEN
ARC WELDING DEVICES

Our machines are simple to operate, having no complicated mechanism. No moving parts to repair or adjust. Very economical, consuming a minimum amount of current. Very portable, weight of standard 50 to 200 amp. welder only 290 lbs.

Give us the opportunity to prove to you the merits of our welding apparatus.

Type U-O

Bare or Coated Electrodes

Owen Electric Manufacturing Company

Fayetteville, North Carolina

SWEDOX

WELDING RODS, WIRES and ELECTRODES

SWEDOX Welding Rods and Wires, differing widely in chemical and physical properties, have one common quality. Each brand is made for a particular welding requirement.

When you consider the care that must be exercised in the selection of metal for different construction requirements, it becomes apparent that equal care is necessary in selecting filler material for welding the joints in these constructions.

The SWEDOX line has been developed so as to furnish on each welding job the welding wire which will enable the welder to get the most satisfactory result. There is a SWEDOX wire for your work. Try it, and you'll know why SWEDOX customers come back.

Central Steel & Wire Company

CHICAGO, ILL.
4545 S. Western Blvd.
Lafayette 8500

DETROIT, MICH.
5001 Bellevue Ave.
Lincoln 6780

Main Warehouses and General Offices, Central Steel & Wire Co., Chicago.

Already a Great Success---

RACO PROCESSED ELECTRODE

A Brand New Product
from a Brand New Plant.

A Full Coated Electrode
at Bare Wire Prices.

Placed on the market to fill an urgent need by the welding industry for an electrode of absolute uniformity at a price.

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EDITORIAL

Ships That Sail the Seas

EVERY ship that sails the seas ought to carry welding equipment and a good welder. Accidents not only can, but do happen, and a complete welding outfit is so low in cost that it represents very cheap insurance against delayed voyages from breaks that might be repaired. Shipbuilders and dry-dock companies are well acquainted with welding and its usefulness, and some ships do carry welders aboard because their masters know how useful they can be. Marine engineers, captains, and mates are generally aware that when a ship is laid up for repairs some welding is apt to be done. A great deal of good might be done by getting these ships' officers better acquainted with welding and getting American made equipment on board as many vessels as possible. Bearing in mind the fact that the quality and performance of our apparatus is admittedly superior, it is not too much to expect that when our ships touch foreign ports there would be wonderful opportunities for demonstrations to important maritime interests. It is true that the potential market for welding equipment at home has only been partly developed, but the day may come when manufacturers will feel the need of foreign trade as an encouragement to expansion. Some missionary work will already have been done if the home market represented by the ships that sail the seas is carefully cultivated.

Laying Out the Pipe Joint

SO MUCH has been written about pipe welding during the last four or five years that we expect to find a welding job wherever pipe of any kind is assembled for any purpose. That part of it is all right. But it must be kept in mind that an essential step in the application of welding to any kind of a pipe line is the proper design of the joints. Making joints with the old fashioned fittings was largely a matter of using a wrench until the prepared joints were tight. Welded joints are better, but they require something more in the way of skill, and a whole lot more preparation. Laying out a pipe joint, whether it be a header, a reducer, a drip, or any other connection, is simple enough if you know how, but full of snags if you try to guess at it. The job is extremely simplified when templates are provided for cutting the different pieces so they will fit properly when assembled. But templates cannot be bought so they must be made. The making of a template is a mathematical problem, but fortunately does not require a complete course in higher mathematics for the pipe welder. Several handbooks on sheet metal work and similar subjects have lifted from the musty texts on geometry just enough instruction in the making of such designs to start the welder making his own templates. Skill in making them is easily acquired by a good mechanic, and they accumulate rapidly for future use if made of substantial material. If you have pipe welding in prospect, make plans to be prepared to cut the joints accurately, right at the start. It isn't so very difficult, but it has to be done.

Where the "Shopper" Gets Stung

WHEN the purchasing agent finds that there are two prices for an article which appears not to vary in quality he is tempted to start "shopping" to find the bottom price. More often than not he goes ahead and does it. Many a good account has become transformed into a total loss as a result of such activity. Who is to blame? The salesmen who let themselves be drawn into a price war? The buyer who thinks it is a stroke of genius to kill the goose that lays the golden egg? Or both? It doesn't matter where you put the blame. When buying on price gets started, values become overlooked, and everybody loses. This has proven true very often in the welding industry. The industry is in a stage of growth, and will be for some time. Its continuous growth promises huge savings and improvements in all metal working industries and many that are not concerned with the working of metals.

It cannot grow, however, if manufacturers are not able generally to sell apparatus and supplies at a profit which allows development work, to effect further economies in application, and educational work, to increase demand so that mass production may reduce manufacturing costs. These future benefits are lost to the buyer who wants more than his money's worth. So are many present benefits in the invisible shape of service and quality which may have to be slighted to meet a price. Then there is always the danger of banking too heavily on the continuance of a bottom price that cannot last because it is economically too low. Even "shopping" for labor has its disadvantages. In fact, it is almost a rule that the lowest labor cost produces a relatively high job cost. Good welding has so many advantages that it is not the part of wisdom to seek economy altogether through the medium of a low price.

Suggestions, Please

WE ARE constantly being criticized for being so conservative regarding the future possibilities of welding. When we estimate that the present amount of welding being done at twenty percent of the amount that could be done if welding were used wherever it would pay, our friends tell us that this figure is outrageously high, that welding is being used today only to the extent of about ten percent of its possibilities. We would like to hear from some of our friends who have not expressed themselves on the subject.

Welding Schools to Teach Electric Process

DURING the past month notice has been received of the establishment of courses of training in electric arc welding in several trade schools in the country. The Portland School of Technology, at Portland, Oregon, is soon to open an electric welding department to train operators for structural steel work. The Columbus Y. M. C. A., Columbus, Ohio, is planning to open up an electric welding school to be run in conjunction with the oxy-acetylene welding school. The Youngstown Y. M. C. A. of Youngstown, Ohio is also planning to install an electric welding machine, their objective being the training of men for the steel industry. This news will be welcome to the men in these cities who are interested in electric welding because there are very few places in the country which boast of a central training point for electric welders and the trade schools have been, in the past, rather slow to put on new courses. There are a great many other localities where schools of this sort could serve a very useful purpose and the men who have tried to secure applications for the process in important industrial centers would undoubtedly find it to their advantage to cooperate with any plan which promises to provide a supply of men who had been systematically trained in the fundamentals of the work. There are, of course, many different opinions regarding the value of practical training which is obtained in such schools but the question should really be approached from the point of view of future possibilities rather than of dissatisfactions which have been experienced in the past.

"Any old welding rod" is *dead*

IN the early days of welding there were "old-timers" who openly bragged that "any welding rod" would do. But that was before the strength of welds had been studied. Now welders know that the tensile strength of the weld is directly proportional to the quality of the rod. Even novices know that quality rod must be specified. That is why Oxweld welding rods dominate the field.

Welders know that Oxweld welding rods are manufactured according to rigid specifications. These rods must pass a careful mill inspection and several rods from every bundle are melted for weldability. Actual welds are made from each shipment and these welds must prove to be of high quality before the rod is taken from the mill.

If you are not using Oxweld rods now, try them and test the resulting welds.

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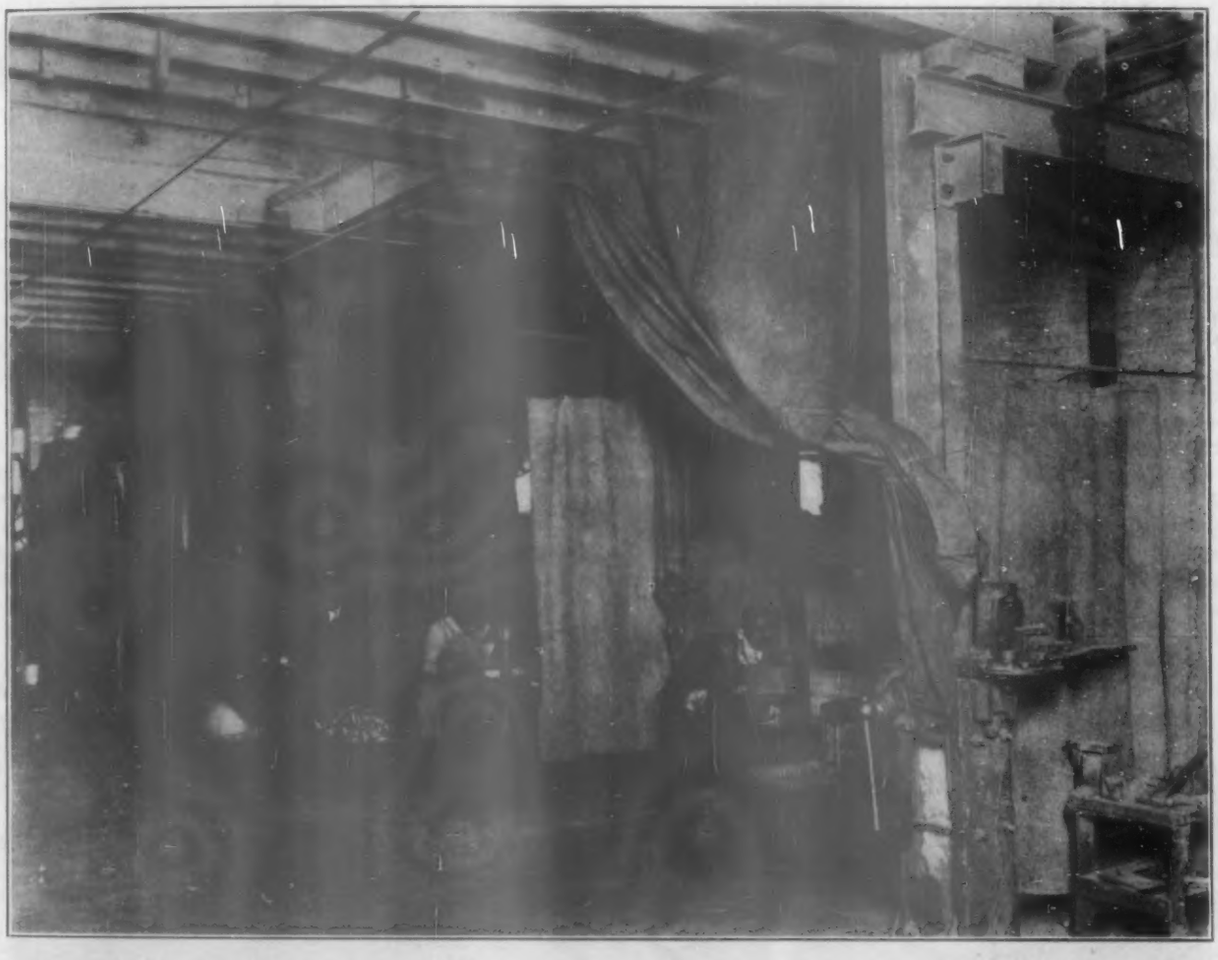
Welding Shop Layout

Arrangements for Convenience and Safety in Shop Where Several Arc Welders Work Simultaneously

ONE of the practical considerations involved in the efficient operation of the welding department is the layout of the shop itself. A number of shop owners and supervisors have found by experience that it has been wise to make provision in advance for every piece of equipment and machinery so that when the shop does get into operation different parts of the work can be handled in systematic order without getting one job in the way of another. Like every other phase of welding the matter of shop layout is one on which there are some differences of opinion but it is generally agreed that systematic methods based on systematic arrangement of equipment prove the most valuable at the times when they are most sorely needed.

Quite a number of interesting suggestions for shop layouts have been published in manufacturers' hand books and catalogs and in past issues of *The Welding Engineer*. The picture which is produced here shows a layout which has proven very convenient in a shop where both gas and electric welding operations are constantly going on. The arrangement is a very simple one. At the right of the entrance is the shop office. Just beyond that on the right hand side of the entrance is a storage space for both materials and equipment not in use, then come the compartments for the arc welding operators. An overhead crane runs down through the center of the shop. The space down through the center of the shop directly in front of the door is large enough to permit bringing in material on trucks or for carrying on welding of some jobs when the shop is crowded. The acetylene welding work is done in the rear of the shop which also has an entrance directly to the outside.

The particular point of interest in this shop layout is not a general feature but a matter of detail; that is the arrangement of the electric arc welding booths. The scheme is one that could well be followed in a plant where there are several arc welders, or in an arc welding school. The space set aside for arc welding is separated from the rest of the shop by one long curtain. It is further divided into separate compartments by curtains which are hung on swinging lengths of pipe. Considerable care was used in the selection of the material for these curtains. It was desired to have them flexible for reasons to be mentioned later and at the same time they had to be both durable and fire proof. A particular grade of asbestos cloth was finally selected and in order to prevent radiation it was sprayed with a mixture of oil and lamp black purposely to give it a dull dirty color. Of course this material has the advantage of being absolutely fire proof and this is an important consideration



An Arc Welding Department That Is Easily Made Into One, Two or Three Compartments. Workers are Safe and Comfortable.

whenever welding operations are going on. The advantage of having the dividing curtains hung on swinging pipes instead of stationary rods is that it allows making one compartment out of two or one compartment out of three simply by swinging the curtains back against the back wall. This is sometimes necessary when large jobs requiring more than one operator have to be accommodated in a single booth are brought into the shop. There is a further advantage in the flexibility of the divisions in that in case an operator slips or the piece he is welding on slips he does not fall or become squeezed against a rigid wall so there is considerably less chance of injuries in case of such accidents. In service this arrangement of the arc welding booths has given the proprietor of the shop really more satisfaction than he expected. There have been no serious accidents, and trouble from burned eyes has been practically eliminated.

CALIFORNIA FLORIST BUILDS NURSERY BUILDINGS WITH WELDING

The E. W. McLellan Company, wholesale florists in San Francisco and Burlingame, California, are now building electrically welded structural steel greenhouses for the housing of flowers and plants. This method of construction, offering many advantages, is attracting the attention of many Eastern wholesale florists.

Two units, each 40 by 800 feet, have been completed, and material for the third unit is now on the ground. The nursery will finally cover 1,000,000 square feet of ground and will be one of the largest in the country. A total of 75,000 carnations and 50,000 roses have been planted in the completed sections.

A General Electric single-operator welding outfit is used in the construction work. The side walls are fabricated with 4-inch by 4-inch I-beams spaced eight feet apart and supporting an 8-inch channel top girder. Roof trusses are fabricated from half-inch iron pipe with ¾-inch solid iron bar for bottom chord. Angle iron, 2-inch by 2-inch, is used for the purlins which in turn support the wooden sash supports. In the third unit now contemplated supporting columns and trusses will be spaced ten feet apart and lighter material will be used.

Four men are employed in the construction of the buildings: one welder, one carpenter and two helpers. It is expected that the third unit will be completed in three months with this construction crew.

The McLellan Company is enthusiastic about the process

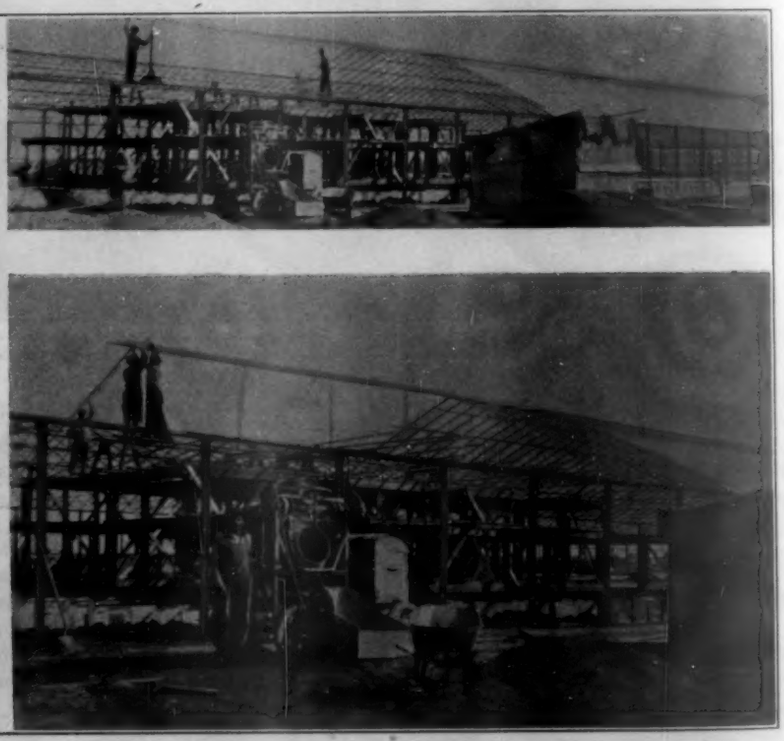
Welder at Work on Welded Greenhouse.

and plans to keep the welding outfit permanently on the ground when new construction is completed. When they want a new tier of shelves in any one of the buildings, they will start the welding generator, assemble the necessary materials and tack the brackets to the structural framework.

REPORT PURDUE CONFERENCE TO CLEVELAND SECTION

At the January meeting of the American Welding Society, Cleveland Section, held January 25th, Messrs. Robert Kinkead and F. E. Hass were speakers for the evening. The main subject for discussion was a report on the interesting program of welding research which Purdue University has been carrying on recently in cooperation with Indiana industries.

Inside View of Greenhouse.



Close-Up of Outside. Outside Partly Completed.

WELDING AND THE WELDING ROD
For Sound Welds It Is Essential to Use Best Materials Available

By E. H. Sharp

Many people have the idea that the "personal equation is the difficult problem in welding." "Everything depends on the Welder," they say, and then proceed to ask "How can I be sure he is a good workman?"

Important though this matter is, it must be emphasized that the workman is only one factor in the correct procedure control. True, you must have good welders (and they are obtainable and teachable and reliable), but they must also have good materials to work with. It is of the utmost importance to standardize on materials of high and unvarying quality.

The best of blowpipes and the highest grade of welding rods and fluxes will so facilitate welding that their use will be soon repaid many times over. Since one of the most important of these items is the rod, the largest manufacturers of welding equipment and supplies are devoting great attention to developing new and improved welding rods.

One of the simpler tests which are commonly used can readily be made by any operator, in order to determine the excellence of his present supply. Place a rod on a welding table so one end extends well over the edge. Then melt it with a blowpipe, watching for impurities or cavities. A good rod will melt easily and quietly with practically no sparkling. Another good test can be made by laying the rod on a metal slab and then remelting it repeatedly. The first time the blowpipe has been moved slowly along, there should be no excessive sparkling, and no pin holes should remain in the melted metal. A second or third application will show proportionately more sparkling and a larger number of pin holes. But if there is a great increase each time the rod is not of very high quality.

A good rod, one which can withstand such tests, gives a good weld because it has no impurities to be left in the weld metal and no gas pockets to prevent steady and smooth flow.

In actual work the operator can recognize good welding rod with no trouble at all. The rod should flow easily without excessive sparkling; it should be easy to control even in overhead welding and should be capable of being worked rapidly. For most work another prime consideration is *strength*; a good welding rod should give a weld which when properly made is stronger than the best quality of flange steel or boiler plate.

One of the first types of rod used extensively, for oxy-acetylene welding was of almost pure iron from Norway and Sweden. When the supply of this material was cut off during the early years of the World War, the low carbon steel or so called "drawn iron" rods replaced them. "Norway Iron" has therefore lost its precise meaning; most of the welding rod called Norway iron is merely a low carbon steel made in the United States especially for its welding properties. The weld metal resulting from its use is practically pure iron, and contains only 0.02 to 0.03 per cent. of carbon. Consequently joints made with this rod, while tough and ductile, are no stronger than the softest staybolt iron.

An important factor which must be anticipated in the development of new welding rods is the change in chemical composition which takes place when they are melted by the blowpipe flame. Consequently they must be of such composition that the metal *in the weld* will be of high quality, sound and strong.

An important development in welding rods is the recent "High Test Rod" put on the general market in 1925. Prior to this, from 1923 to 1925 operators employed in railroad shops all over the country used this type of rod. It was their success with it that created the general demand. Welds made with this rod, whether by second rate or by the best of operators, will regularly average 11,000 lbs. per sq. in. stronger than welds made by the same man with low carbon steel rod. It is an alloy steel, its essential chemical composition being carbon 0.20 per cent; manganese 0.30 per cent; silicon 0.55 per cent. The weld metal retains nearly all the carbon. The Manganese and silicon lost in melting act as a self-flux. Hence the strength and soundness of joints made with it.

Every welding operator, and every manager who directs welding operations, will find that quality and correct composition in welding rods is a matter of utmost importance. Given good rods, a good welder can be sure of the highest possible strength and quality in his welds; and even a welder of indifferent ability can improve results by wise selection of such material.

*Technical Publicity Department, Linde Air Products Co.

THE ARC WELDER IN THE JOB SHOP

By J. E. Rork

The range of work that may be accepted for repair in a job welding shop is considerably broadened by the application of the electric arc machine. One example of this that recently came into our shop was the correction of the design of a manganese steel jordan plug. No other method of welding or fastening the bosses into place could be used as satisfactorily as by electric arc welding. The jordan plug for its present use had been designed with too large a space between the webs which allowed the paper stock to travel through at too rapid a pace. To correct this fault we electric welded triangular shaped bosses between the webs. This lessened the pace of the paper stock as it traveled through the Jordan. Acetylene welding in this case would have been utterly impossible as heating the casting would spoil the heat treatment of the steel, and also would undoubtedly cause it to crack.

Another application of interest is that of building up large worn shafts, some ten to fourteen inches in diameter, stock being added and machined to fit a gear or pulley to go on the shaft. Key-ways in large shafts may be readily repaired with the use of the electric arc without warping the shaft if the work is carefully done. The use of the electric arc machine in the welding of iron castings often times saves considerable time and labor as the castings may be set up in place for welding and quickly tacked together with the electric arc process and then welded with acetylene. However, with the malleable iron castings the electric arc welding process may be used and then reinforced with Tobin bronze. Very often large pulleys with broken spokes are brought into the job welding shop for repair. This repair is a very difficult one to make with the acetylene process as it is generally necessary to pre-heat the whole pulley. We have been most successful in the repair of these pulley spokes by arc welding a band of steel around the pulley spoke which eliminates all danger of cracking from the pre-heating and also saves considerably on the labor charge of the job.

The job welding shop is very often asked to build up teeth in differential automobile gears. This has been a very difficult job due to the fact that in order to weld the teeth in the gears it is necessary to heat a portion of the gear and thereby spoiling the case hardening in this portion. With the electric arc process the teeth that are welded are the only ones that would be in danger of being too soft. A repair that we recenly made was of the welding of a five-inch shaft in an agitator by the electric process. There was very little ventilation in this compartment and it would have been almost impossible to weld it with acetylene as the pre-heating and burning of gas would have made it very difficult for the operator. We find that on the majority of jobs that come into the shop we use the electric arc machine during some portion of the work. For instance, the repair of broken crank cases. Although we do not use the electric arc in welding the aluminum crank case, we do use it in the set-up, that is, if the shaft is a little bit too small, stock may be added and then machined down to fit the bearings which saves the expense of an entire new shaft. Also in making jigs to hold the packing on the inside of the case preparatory to welding we use the electric arc machine.

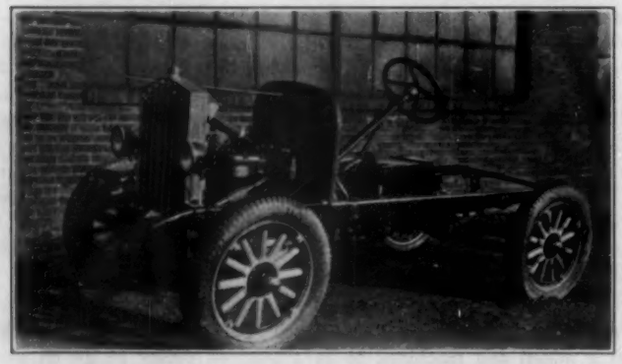
It would be quite impossible to cover all the applications of the electric arc machine as it is generally known that this process is more economical on the welding of tanks, boilers, steel pipe, etc. on the production basis. We also have found

it to our advantage in our shop to use the electric arc process for the welding of cracked water jackets and repairing cast iron crank cases.

All in all, the acetylene process may be rightfully called the "right hand," that is, the most necessary attribute to the job welding shop, and, the electric arc process the left hand; and by this efficient combination the job welding shop reaches a greater degree of efficiency with a greater earning capacity than it would be able to do otherwise.

RANDALL'S STUDENTS EXHIBIT ALL WELDED COMPOSITE AUTO

Among the interesting exhibits at the Cleveland Automobile Show was a small automobile built by the welding and automobile students at the Cleveland School of Technology under the



Welded Auto, Expected to Make 85 Without Casualties.

direction of Reg. K. Randall. This car was made up of various units taken from standard automobiles, cut and welded to the sizes desired.

In order to get a small wheel base of 72" from a Star frame, a section was cut from the center and then the frame welded together. A Ford rear end was narrowed 10" to give a tread of 42" by cutting 5" off each side and then welding. The steering column was made by assembling a Ford and Maxwell column together by welding. The battery box was an agle iron frame all welded and attached to the chassis by welding. The front axle was made by cutting a Chevrolet axle to desired length and welding together.

After the chassis was completed a 15 H. P. Le Roi motor having a 3⅛" bore and 4½" stroke was installed. Seiberling All-Tread tires were put on the Whippet wheels, Auto Pulse gasoline system installed, Houde shock absorbers were put on rear springs. A Ford radiator with special shell mounting was added, Cleveland rear wheel brakes attached to wheels and adjusted, and an A. C. 100 mile per hour Speedometer attached.

The car is now waiting for some warm day when it can have a good opportunity to get out on a track and see how much it can do.

Many questions as to the strength of the welded parts were asked at the show but the builders say that they are not afraid to ride at fast speeds in their welded car, as the danger of their welds breaking is no greater than the possibility of a bolt or nut breaking or shearing.

The car is expected to attain a speed of 85 miles per hour.

UNDERWRITERS LABORATORIES REPORT ON ACETYLENE ACTIVITIES

In the annual review number of Laboratories' Data, January 1927, the Underwriters Laboratories make the following report on the work of the department of gases and oils on the subject of acetylene:

"The Department's work in connection with acetylene has shown more activity than has been the case for several years past. This activity included the investigation of a number of lighting generators, and several generators of a special type used in the oxy-acetylene welding process, including both portable and stationary devices. A number of meetings were held with the manufacturers interested in oxy-acetylene welding apparatus, as a result of which a complete revision of the Standard for Construction of Stationary Automatic Acetylene Generators for Welding has been finally reported for adoption.

Progress also has been made in the preparation of tentative standards for portable automatic acetylene generators for the oxy-acetylene welding process. This particular industry is one which has long been considered as so thoroughly stablized that radical changes in standards and activity in production of new devices could not be expected. The growth and the use of the oxy-acetylene welding process and its adoption by an ever-increasing number of industries has resulted in such changes and improvements that work in this division may be expected to increase rather than to decrease or stand at a constant level."

The casualty and automotive department also reports:

"Some unusual pieces of equipment applying to the oxy-acetylene industry have been investigated. Industry conferences have been held to discuss revisions of standards of oxy-acetylene welding and cutting blowpipes, or torches and pressure regulating devices."

UNDER WATER CUTTING

For the meeting held February 1st by the American Welding Society, New York Section, a paper on "Under Water Cutting," by Commander Edward Ellsberg of the Tidewater Oil Company was scheduled. The paper was illustrated by lantern slides showing the nature of the work.

First Oxygen Plant in State of Kansas.

KANSAS HAS NEW OXYGEN PLANT

People who are in the habit of speaking about Kansas as the champion dry state of the Union will probable be amazed at the thought of getting liquid air anywhere in the state. But this theory did not stop the Kansas Oxy-Acetylene Company from putting an Oxeco air liquefaction plant into operation in Wichita. Above is a photograph of the complete works, including acetylene generating and compressing plant, office building, oxygen generating and compressing plant and warehouse; all new and modern buildings and equipped with up-to-date machinery throughout. This is reported to be the first oxygen plant erected in the state of Kansas. Mr. C. D. Stewart is the manager of the new plant.

The Flow of Welding Metal

Slow Motion Movies, Taken with Infra-Red Light on a Special Film, Are Used to Show Welding Qualities of Filler Rods

By J. B. Green*

FUSION welding and cutting processes are now so extensively employed that everyone interested in joining and cutting metals has at least heard of them. Those who have an intimate knowledge of the present state of the art are very enthusiastic regarding what they term its future possibilities. Not everyone, however, has paused to consider what these possibilities are and how they will be made realities. The fact is that nearly everything depends on the development of filler material. Welding and cutting torches, generators, methods and the skill of the workmen have reached a relatively high state of perfection. The welding rod is the laggard. Until recently, progress in welding rod development has been made almost entirely by cut and try. The Research Laboratories of the Chicago Steel & Wire Company were pioneers in developing the fundamentals of welding rod design. Knowledge of these fundamentals makes it possible to design a filler rod for a specific purpose as an engineer would conduct his design work in any of the other more highly developed arts. Startling results have been accomplished which will make possible hitherto undreamed of applications

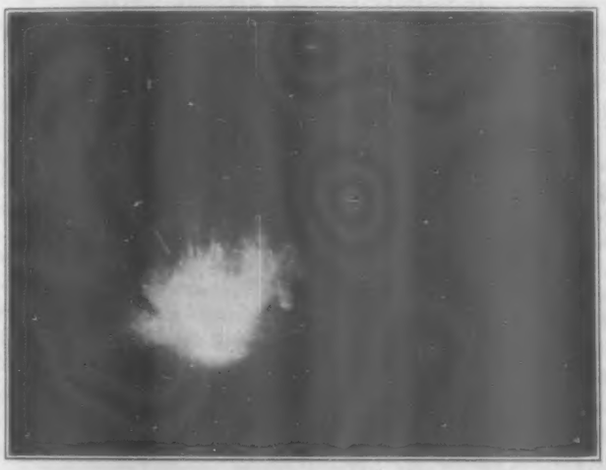


Fig. 1—Conventional Photograph of the Metallic Arc.

for fusion welding and cutting. Most of this work is still in the laboratory for many reasons. Conservatism is one and another is the fact that the Research Laboratories are maintained for commercial purposes. A large outlay of capital has been required and this must naturally be protected by patents and trade secrets. This article describes some of the work of the Research Laboratories on the flow of welding metal. Specific information derived from this work which concerns welding rod design cannot be divulged, but the description of the methods used in conducting the study should be very useful. They are the methods of research, not of cut and try. They lead directly to the answer and, to those not familiar with such methods, they accomplish the seemingly impossible.

Photographing the Transfer of Metal

It does not require the mind of a genius to appreciate that motion picture photography is a very effective means for studying the flow of welding metal. Many men interested in the subject have attempted such photography, but the Research Laboratories of the Chicago Steel & Wire Company were, so far as is known, the first to succeed in photographing the actual transfer of the metal.

The taking of these motion pictures required over a year's work, much of which is so novel that a short account of it may prove interesting. Photographing the metallic arc is more difficult than photographing gas welding if the actual transfer of the metal is to be clearly seen. There was no precedent available as a guide for taking these pictures so first the intensity of the light reaching the film was successively cut down by stages, but the passing metal never really be-

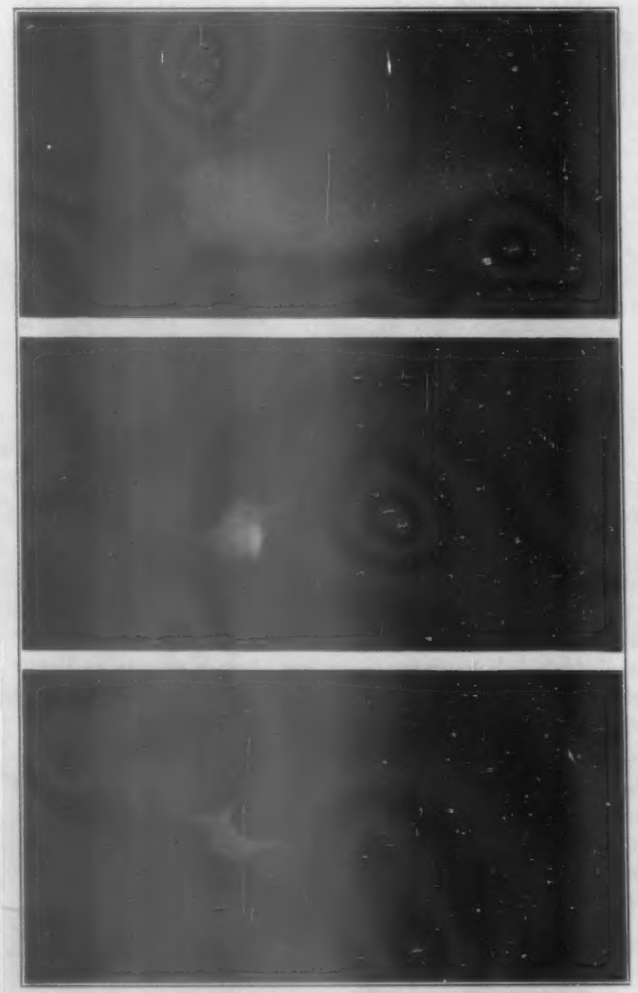


Fig. 2—Three Stages of the Transfer of Arc Deposited Metal.

came visible. Next, a series of light filters were used of such a nature that each one of them eliminated all except one color. Thus pictures were taken with monochromatic light, starting with ultra violet, violet, blue, green, etc., on down the spectrum. This gave the first encouraging signs. As filters approaching the red end of the spectrum were reached, faint

*Research Department, Chicago Steel & Wire Company.

Fig. 3—The Steady Core.

Fig. 5—Saturated Arc.

Fig. 6—Coating Produces Small Drop.

images of the metal in transfer could be detected. Ordinary film, however, is not sensitive to red light. As everyone knows a red light is used in the dark room to develop pictures because this light has no effect on the photographic film. Fortunately during the late years of the war, the Eastman Kodak Company began experimenting for the purpose of producing a film that not only would take pictures with red light, but even with the still longer infra-red rays which are entirely invisible to the eye. The object of their work at the time was to produce a film which would permit taking clear snap shots through smoke scenes, fogs, etc., which no visible light would penetrate. It is a known fact that infra-red rays readily pass through such apparent obstructions just as X-Rays

Fig. 4—The Erratic Core.

go through the human body and even metals and the like. The War and Navy Departments have found good use for this infra-red sensitive film and more recently astronomers have been able to photograph the surface of such planets as Venus which hitherto were invisible because always covered with clouds.

Finally it was discovered that the big obstacle to photography of the transfer of welding metal was the haze that surrounded the action. After making a spectrographic analysis of the light from welding, a slight modification of the infra-red film for this special purpose made these slow-motion movies possible.

Classifying Filler Material

Everyone interested in fusion welding has heard welds described as good or bad and filler rod as being a good working or a poor working one. They recognize that a filler rod has what are called 'operating characteristics" and the deposit metal possesses what are called "weld properties." All too many stop when they refer to these matters as simply good or bad. To make them better, a much finer classification must be generally recognized and understood.

Operating characteristics may be represented for gas welding by clarity of the flow of metal, nature of the slag and action of the deposit metal and, for electric rod, by arc steadiness, melting rate, penetration, deposit efficiency, etc. Each of these may in turn be subdivided as, for example, arc steadiness can be represented by a statement of the arc type. There are four types, known as the "erratic core" type in which the arc pulls off as an incandescent core first from one spot then another, usually around the neck at the top of the molten drop; the "steady core" type in which the arc pulls off from one spot, usually at the bottom of the molten drop; the "saturated" type in which the arc covers the entire end of the electrode uniformly; and the "sheath" type, in which the arc leaves from the equator of the molten drop and resembles the saturated type, but with a hollow center. It is far better to state the operating characteristics or weld properties in terms of such units which go to make them up and then say that a rod is suited or not suited to a particular job, than to merely refer to the rod in a meaningless way as good or bad.

The qualities of any particular filler rod are the result of the particular combination in that rod of the four fundamental considerations of welding rod design which in turn are the result of the processing by the manufacturer. These four fundamentals are (1) chemical composition of the rod, (2) physical structure of the material of the rod, (3) composition of the surface materials and (4) structure of the surface materials. An almost infinite number of combinations of these fundamentals is possible, each combination giving the rod a definite character when used. If the difference in character of two rods is great, anyone will recognize it, but if the margin is narrow none but the trained observer can distinguish the rod. Again, lack of familiarity often makes it impossible to distinguish what are really wide differences. For example, if we are introduced today to ten Americans all strangers to us, we stand a fair chance of recognizing them tomorrow, but if ten Chinamen are substituted, tomorrow they are just Chinamen, and whether we met any of them the day before or not would puzzle us to decide. To make progress with the application of fusion welding, it is not enough merely to be able to tell gas welding from electric, then lose interest and cover all the rest of the cases with the meaningless words "good" or "bad." We must, for example, readily recognize an erratic core type arc, and the like, know something about its cause and a great deal about its influences on the finished weld.

Filler Rod Affects Every Phase of Weld

The character of the rod has some influence on nearly every phase of welding. Such influence is a big subject to study in detail and this article will attempt to cover but one item, that of the flow of metal in gas and electric welding. Even this will not be completely covered, but merely by a few examples of extremes to point out in a general way the effect of various combinations of the four fundamentals on welding rod flow.

Fig. 7—Coating Produces Large Drop. Fig. 8—Only the Coating is Visible. Fig. 9—Here the Coating Forms a Rigid Crater.

In Figure 1, the metallic arc is shown as it appears when photographed on ordinary film without the use of light filters. The picture is fantastic but nothing of especial interest can be learned from it. Pictures similar to this one were used to measure the speed with which flying globules of metal left the arc zone. This could be determined by carefully timing the exposure then enlarging the picture to actual size. The flying globules appear as streaks of light and the length of this streak represents the distance traveled by the globule during the time the camera shutter was open. In this way, it was found that the globules usually leave the arc zone at the rate of about 50 feet per second, an interesting bit of information but not extremely useful.

Mechanism of Metallic Arc Transfer

In Figure 2, the arc has been photographed with infra-red light. It shows that the metal passes across, when a short arc length is held, by capillary attraction. The arc actually goes out, the metal necks off and the arc is re-established. This cycle is passed through so quickly that it is practically impossible to study it, at least to be sure of its nature, by ordinary observation. The motion pictures taken show this repeatedly and should settle the question of the mechanism of metallic arc transfer. The metal does not always cross in this fashion for it may simply drop across, but with the short arc required to produce good commercial welds, most, if not all, the metal passes to the deposit in this fashion. There is much evidence that other agencies accelerate or retard this action. A full discussion, however, would carry this article to unreasonable length.

Influence of Structure

A volt meter placed across the arc plus ordinary observation of the arc itself permits rather accurately comparing the stability of arcs from various electrodes, but the motion pictures go farther and point to the causes. In Figures 3 and 4 are shown the typical arcs from two rods of the same analysis. The difference between the two was only one of the structure of the metal of the rod itself. The structure, so far as has been determined, may not directly influence the arc but it most certainly has an indirect and very important influence. The arc stream must take the path of least electrical resistance and, no doubt, differences in resistance far too small to be measured guide the arc. If the vapors surrounding the arc stream have a relatively high resistance, the arc is forced to the center giving rise to the steady core type shown in Figure 3. On the other hand, if the surrounding vapors are of relatively low resistance the arc is literally kept away from the center of the drop and pulls off from points around the upper edge of the drop. Such an arc jumps around in a crazy manner pulling off from one point, then another but never near the center of the drop. This gives rise to the erratic core type arc shown in Figure 4. Extreme cases have been selected for the illustrations but all gradations between these may be found. The difference in resistance causing any given electrode to tend toward giving an arc of one type or the other may be infinitesimal, but to the welder the difference in operating is enormous. Most any welder can easily make a good weld with an electrode flowing like the one shown in Figure 3, while the most skillful man finds it almost impossible to do good work with an electrode giving an arc as shown in Figure 4.

Influence of Surface Composition

As the current density of the arc is increased, the diameter of the core increases and the arc changes from the core type to the saturated type. By proper control of the four fundamentals of electrode design, the arc may be made to tend toward the core or saturated types. It happens that the composition of either the rod or surface materials may be used to control. In Figure 5 is shown a saturated type arc running at the same current density as the steady core type shown in Figue 3. Here, the chemical composition of the rod was changed to alter the arc type. As a rule, the welder can do better work with the saturated than with the core type arc. There is still another type, known as the sheath type arc

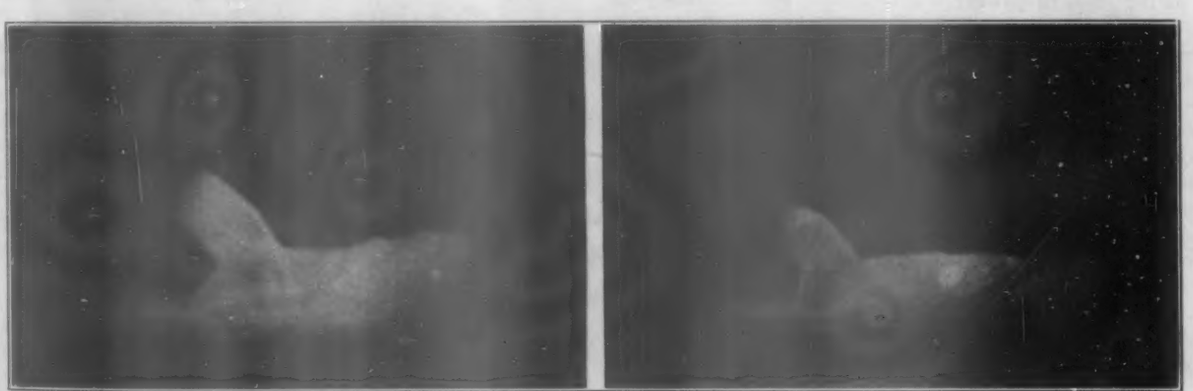


Fig. 10—Gas Welding With Wire Made for Electric Welding. Fig. 11—Gas Welding with the Coppered Rod.

which is like the saturated only with a hollow center. Unfortunately so much detail is lost in half tone reproduction that it is impossible to clearly show this with a printed illustration. Apparently the tendency toward a sheath type depends entirely on the composition of the surface materials. It is probably the most valuable type of all, because it seems that only by producing this type can the flow of metal be speeded up without a corresponding loss of arc stability. It is comparatively easy for a competent electrode designer to make rods that flow extremely fast but unless a sheath type arc is employed, the faster the flow the lower the stability.

The composition of the surface materials greatly affects the size of the molten drop. In Figures 6 and 7 are shown arcs from low carbon iron electrodes of identical chemical composition. These rods were flux coated, the fluxes differing widely in chemical composition. By referring back to Figure 3, the size of a normal drop from a low carbon bare electrode of the same composition may be seen. In Figure 6, it is easy to see that the coating has made the drop much smaller, while in Figure 7 it is much larger. In all cases, pictures have been selected showing the largest drops from each electrode. It is very much easier to make good welds when the elctrode gives small drops. A shorter arc length may be held. While the arc from the electrode used for Figure 7 is practically as silent and steady as the carbon arc, still, because the drops are so large, the arc length increases from ⅛ inch to ¼ inch every time a drop passes, which means the welder must compensate for the sudden change of arc length with every drop, or the arc goes out.

Fig. 12.—Conventional Photograph of Gas Weld Made with Rod Free from Impurities.

Fig. 13—Gas Welding with Rod High in Impurities.

Influence of Surface Structure

The structure as well as the composition of the coating affects metal flow. This is probably best seen by observing an arc coated with silicates, first, in the form of asbestos yarn, then, in the form of powder. In Figure 8, the asbestos yarn is shown flowing down in a molasses like mass, incandescent, however, from the electrode over the deposit. In Figure 9, the coating forms a rigid crater with the arc burning up inside. Control of the coating structure often permits the electrode designer to accomplish the seemingly impossible in welding. Work along this line is still in progress in the Research Laboratories so it cannot yet be divulged. Just to illustrate, it may be permissible to give one out of the hundreds of startling applications. Stainless steel may now readily be cut, something which has not been possible by oxygen cutting methods.

Influence of Impurities

Another point that the motion pictures have emphasized is that of the significance of solid nonmetallic impurities called Sonims in metallic arc electrodes. It is now certain that the importance of sonims has been greatly over-estimated. Much depends on their nature but it is more proper to look on them as an included flux. It has been shown that the flux on the surface of the electrode has a great influence and that this influence varies widely. It may make a rod more or less suited to a particular job. To say, however, that sonims are bad is like saying that all fluxes are bad. The metallic sheathed electrode often used for automatic welding carries considerable inclosed flux. This really is analogous to excessive sonims so far as the location and quantity of the material is concerned, but not necessarily so far as composition. Everyone knows that on work for which it is suited the metallic sheath electrode is a very excellent one and, because the fluxes are enclosed, accomplishes things that cannot be done otherwise. The point is that sonims just because they are inclusions in the metal are not necessarily bad. What they are is the determining factor and it so happens that they very often represent the identical materials commonly used for flux coating. What has been said concerning sonims in metallic arc electrodes, in no manner applies to gas welding rod as will be explained later.

Differences Between Gas and Arc Welding

Viewed from the standard of filler material there is a wide difference between gas and metallic arc welding. In gas welding the source of heat and filler material are subject to independent control while in metallic arc welding they are not. On this difference largely rests the advantages and disadvantages of the two methods. In gas welding the filler material, because it is controlled independently of the source of heat, has not the significance that it has in metallic arc welding. This is one reason why gas welding really developed first and reached a high state of perfection while metallic arc welding was still in its infancy. In the past it has permitted doing work that has been considered impossible by the metallic arc process. The quality of the work is very largely dependent upon the skill of the operator and probably always will be. On the other hand because the source of heat and filler material are tied together in metallic arc welding, the opportunity is presented of introducing into the filler material a major portion of the required skill. It is easy to appreciate that as soon as the fundamentals of electrode design are known and properly applied the quality of the metallic arc weld can be more readily standardized. Wherever possible it is more practical to standardize materials than it is human skill.

Influence of Impurities in Gas Welding

So far as the flow of metal is concerned in gas welding the principal items to observe are clarity of flow and the tendency of the metal to boil. The clarity of flow has quite definitely been shown to depend on the presence of solid non-metallic impurities in the filler rod or on its surface.

These impurities or sonims, no matter what their composition, all seem to be detrimental to gas welding rod.

The motion pictures taken with infra-red light permit a study of this matter far better than can be done by ordinary observation. Apparently the sonims radiate far more infra-red light than they do visible light while in the case of the molten metal just the reverse is true. After a careful study of the matter it becomes possible to identify a number of the more common materials appearing as sonims in steel by merely examining the photographs of the weld puddle taken with infra-red light. The commonest effect produced by sonims is a scum which apparently comes down off the surface of the filler rod as it melts and spreads out over the weld puddle. This may vary all the way from an extremely thin layer to one so heavy that it seems to have a heat insulating effect seriously retarding welding. In Figure 10 the weld puddle is shown completely covered with a blanket of this scum. The rod used in this case not only contained scum forming sonims but also was a dry drawn rod such as is used for electric welding. It therefore had considerable lime on the surface which produced an extremely heavy scum differing but slightly in appearance from the scum formed by the sonims of the rod itself. In Figure 11 is shown the weld puddle from a coppered rod free, of course, from lime and other non-metallic substances on the surface but containing two forms of sonims in the rod itself. One of these sonims forms a scum and the other coagulates part of the scum forming what welders often call floating white specks. One of these can be seen on the top of the weld puddle in fdont. In Figure 12 is shown the weld puddle from a rod free from sonims. The metal looks burnished.

In Figure 13 is shown the deposit from a rod which is seldom found in practice. Probably 15 to 20 per cent of the weight of this rod was non-metallic. The sonims in order to become as thoroughly mixed with the metal as they did in this case must have nearly the same specific gravity as the metal itself. The specific gravity of most sonims is much less than that of the metal and consequently they have a very strong tendency as a rule to float to the top. Such floating sonims can be controlled by the welder and while they interfere with his work and tend to cut down production, a skillful workman can always see to it that they do not in any manner affect the weld quality. When, however, the sonims are the nature of those contained in the rod used to make the weld puddle shown in Figure 13, the matter becomes entirely beyond the welders control. The metal banks up and it is impossible to lay down a bead. Fortunately rods of this kind are extremely rare. In fact, it is almost impossible to deliberately produce such steel. The Research Laboratories found it necessary to make a wide search among their friends to secure the sample which was used. The picture is included with this article merely to make the treatment of the subject more nearly complete.

The microscope is generally considered the most practical means for identifying the sonims in steel. It so happens, however, that the particular sonims which the gas welder is most apt to meet are so extremely small and so readily confused with carbide when examined under the microscope that they are quite difficult to detect. On the other hand, most any welder with a little practice at critical observation can identify these sonims himself by merely watching his weld puddle. As previously stated the more common sonims are an annoyance to the welder rather than a serious defect.

Boiling of Deposit Metal Explained

The boiling of the deposit metal implies motion and consequently it is impossible to adequately show it with still pictures. This boiling is of two kinds, that which goes on while the torch plays on the molten metal and that which continues after the torch has been removed. One is due to the gas which is evolved from gas forming materials in the metal. Heat is required to cause this gas to form. The other type of boiling which takes place after the torch has been removed is probably due to the fact that metals dissolve gas quite readily when they are highly heated but the same gas is far less soluble in the metal when it cools. Thus a weld puddle may be entirely free from boiling so long as the torch plays on it but when the torch is removed the metal begins to cool, the gas is thrown out of solution and bubbles to the surface.

This study of the flow of welding metal is an attempt to pick the phenomena to pieces resolving it into its elements so far as the various effects are concerned, then one at a time determining the cause of each effect. After the cause has been determined the welding rod manufacturer must then know how to arrange his process to that he can control each one of the factors independently. He then has the facilities to deliberately design a filler rod which will meet certain specifications in so far as the flow of metal is concerned. This is the method of research and contrasts strongly with the cut and try method which not only is tedious and uncertain but which never furnishes the basic data to permit deliberately designing a welding rod. This article concerns only the flow of welding metal. The same methods, however, applied to all the other phases of welding produce the same sort of results. The total of all the data on these various phases represents the welder rod designer's handbook.

The Research Laboratories of the Chicago Steel and Wire Company are pioneers in recognizing that there is such a thing as welding rod design and in developing the data on which it may be based. The work indicates that filler material used in fusion welding can be made a far more important factor than has hitherto been recognized.

(NOTE:—*The series of reproductions necessary to bring the accompanying photographs from the movie film to the printed film have unfortunately destroyed a great deal of the interesting and valuable detail which is clearly evident in the originals, when projected on the screen. But although these pictures fall far short of illustrating the value of motion picture photography in this study, it is felt that they show enough to be of real interest to our readers. The complete film, we are told, is now available to engineering schools and societies and other groups interested in the study of welding.*—EDITOR.)

THE INSTITUTE OF METALS

At the Annual General Meeting of the Institute of Metals, to be held in London on March 9th and 10th, seventeen papers are expected to be submitted. In the evening of March 9th the annual dinner of the Institute will take place at the Trocadero Restaurant. Following the dinner at which there will be a curtailed toast list—a dance will be held. This dinner dance is the first function of the kind to be arranged by the Institute.

The annual autumn meeting of the Institute of Metals will be held at Derby in September. Arrangements for the meeting are being made under the direction of Sir Henry Fowler, K.B.E., LL.D., of Derby. Sir Henry, who is Chief Mechanical Engineer of the London Midland and Scottish Railway Company, has just been appointed a Vice-President of the Institute.

The past year witnessed a steady growth in the membership of the Institute of Metals in spite of Great Britain's industrial troubles. The membership on December 31, 1926, was 1801, as compared with 1692 a year previously. If this rate of increase is but slightly raised during 1927 the membership should reach the 2,000 mark before the Institute celebrates its 20th anniversary next year. The next election to membership is due to take place on January 19, followed by another on February 23. Particulars of the Institute, incorporated in a newly issued booklet, can be obtained by intending applicants for membership from the Secretary, Mr. G. Shaw Scott, M. Sc., 36 Victoria Street, London, S. W. 1.

Torch Manipulation in Welding

Movements of the Torch Are Not Just to Keep It on the Jump—Every Motion of Torch Has an Effect on the Weld

PROPER manipulation of the welding torch is admittedly a matter of mechanical skill. The remarkably uniform results obtained by some gas welders could never be secured by simply studying the principles of the process. On the contrary, uniform work is the result of practical experience based upon a definite plan of action. In other words the expert welder has a definite scheme for manipulating both the torch and welding rod and whether his particular style of operation has been worked out from a drawing in his case, or not, it will usually be found possible to make a diagram

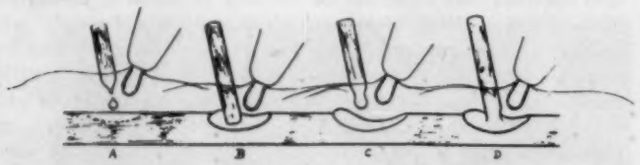


Fig. 1—C and D Show How to Add Filler Rod.

of his motions. For the benefit of the beginner it might be just as well to note that he can expect to spend considerable time with such a diagram before he can reproduce the expert's work with any degree of perfection.

In this article are reproduced a large number of drawings showing standardized motions of the welding torch and the welding rod. The purpose of these is to show the mechanical end of some of the most important applications of gas welding. These illustrations have been taken from Kerr's Training Course for Welders, and it is through the courtesy of Kerr's Welding School, of Los Angeles, California, that permission has been obtained to reproduce them in this way. The illustrations are taken from a number of different lessons,

Fig. 2—Wasting Heat.

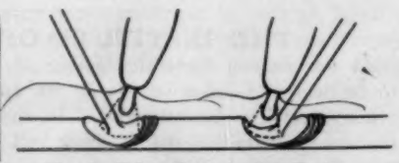


Fig. 3—Using Heat to Get Fusion.

because torch manipulation differs slightly from one application to another and consequently it is not a subject which could be expected to be confined to a single lesson for the student.

In Figure 1 there are illustrated some points which are elementary but they are reproduced here because they are of such fundamental importance. A comparison with other illustrations in the article will show that in the examples of good work the principles shown in Figure 1 have been carefully observed. The first illustration is a caution against melting drops of filler rod onto hot metal. The second portion (B) is another caution against putting the end of the cold rod into the puddle and thus chilling it. C and D show the correct method of adding the filler rod to the puddle. When the puddle is melted and the end of the rod is heated until it just begins to melt then insert the melted end of the rod into the puddle and keep it there, and add metal by directing the melting zone onto the puddle and the rod at the same time.

Figure 2 is used to show how heat is wasted when the flame is held too far from the metal. This position of the flame is practicable only when welding aluminum or bronze. In figure 4B a method of manipulating the torch so as to reduce the heat is suggested. Figure 3 illustrates the position of the rod and flame in the puddle, which insures solid fusion. Note the rod is kept within the melting zone and in the middle of the puddle.

The small sketches in Figure 4 illustrate the principles of building up metal with the torch. In the first one the metal is shown running over, this being caused by slanting the

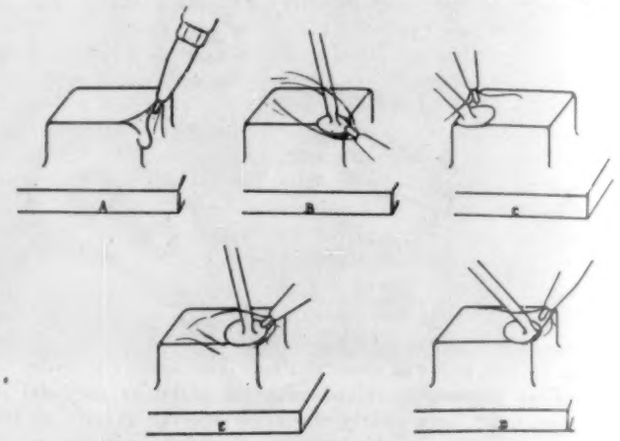


Fig. 4—Finishing Corners.

flame directly down until the rim of the puddle extends over the edge. At B is indicated how the flame can be slanted on its side and toward the center of the weld, using only the side of the melting zone to melt a small puddle that will not run over. At C the rod is shown acting as a blocking agent between the outside rim of the puddle and the melting zone. At D the rod is being used with the poking stroke to fill out the rim of the puddle on the corner. At E the rod has been pulled back slightly. In this sort of work it is necessary to watch the puddle very carefully so that the outside rim just reaches the edge. These principles have to be followed to get good results in building up on castings.

Fig. 5—Drawing Small Rod.

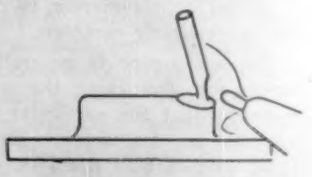


Fig. 6—Drawing Rod off Corner.

Two rather unusual stunts with the torch are shown in Figure 5. In the first illustration the operator is making a small rod out of a large one for fine work. In the second the rod is being drawn out of the puddle slowly so as to eliminate the chilling effect of the rod on the puddle. The rod is connected to the small puddle by a fluid stream of metal.

Many welders get a poor start by assuming that it is only necessary to keep the flame in rapid motion, having observed experienced welders at work and noticed that the torch was moved around a good bit. The best way to learn to manipulate the flame properly is to practice holding it steady until

a complete control of the puddle is acquired then the welder can begin to direct his flame so as to carry the puddle just where he wants it. The puddle itself must be kept round in shape, large enough in size, even in width with its front end and side melting into the metal under it, and the flame must be properly directed to accomplish these results.

Figure 7 shows the position of torch and rod for what is called puddle welding on cast iron pipe. The cross-section shown at A illustrates how one puddle is melted into the preceding one. At B the same idea is illustrated from a different point of view so as to show the advantage gained by beveling. Figure 8 illustrates the method of melting into a

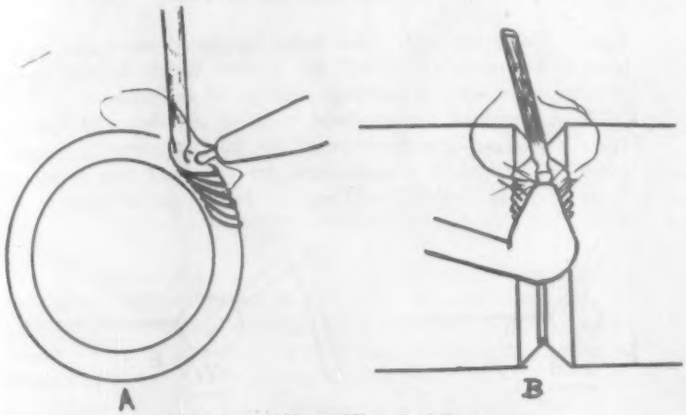


Fig. 7—Puddle Welding Cast Iron.

crack. Without adding filler rod to the first puddle, start the weld by melting the puddle to about ½-inch diameter then force the fluid metal from the front of the puddle to the back by pressing the flame into the front end as shown at C and make the pressure blow the liquid metal from the front to the back without the white cone touching it. The white cone should not touch the metal as shown at A in Figure 8. If the operation is followed as suggested at C in Figure 8 the displaced metal will swell up the back of the puddle, then the welder can move ahead and melt the next puddle and continue adding puddle to puddle.

Ripple welding is a favorite subject of discussion for steel welders, particularly those engaged in pipe and tank work.

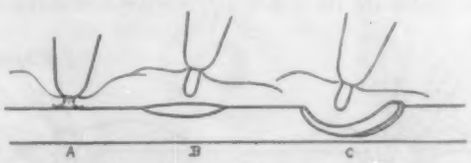


Fig. 8—Working Into a Crack.

Mr. Kerr points out that it is not a particular motion of the filler rod or torch flame that produces ripples, but that they are the result of melting a round puddle and moving it along the surface. Evenness in the ripple and the width of the weld depend upon the evenness and steadiness with which the torch is handled. Figure 9 illustrates the crescent movement method of making the ripple weld, the flame following the rod. A shows how the rod, held between the melting zone and the opening, acts as a blocking agent preventing natural penetration. B shows how the rod is moved into the left side of the puddle to remove the blocking effect, and the melting zone pressed into the crack. The flame is then pulled back as at C so the white cone will not touch the rod and the rod is moved with a semi-circular motion to the other side of the puddle. While the rod is in the other side of the puddle the melting zone is again pressed into the crack, melting it to the bottom edge, as at B, the rod alternating with the movement of the flame. In Figure 10 the position and movement of the rod in the puddle are shown in the small sketch. A shows how the flame must be carried in line with the crack and divided evenly over both sides so they melt equally. The puddle melts farthest back directly under the white cone. B

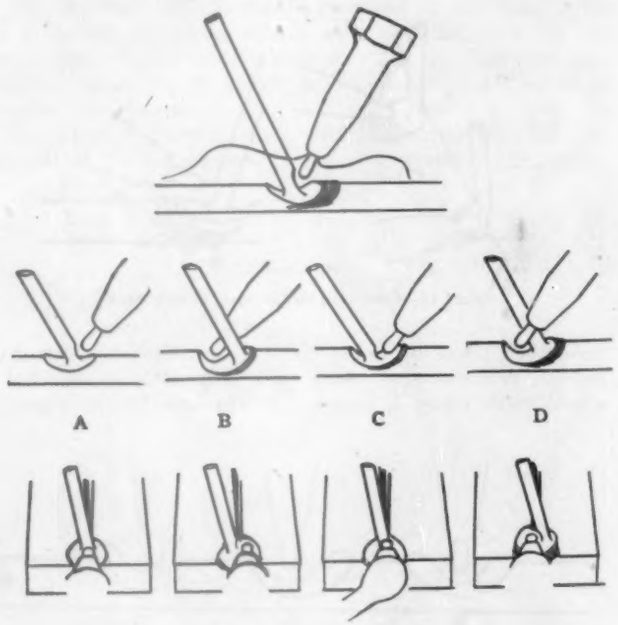


Fig. 9—The Ripple Weld.

shows how the puddle takes on a lopsided shape when the flame is not carried in line with the crack. C indicates how to hold the rod in line with the crack and move it from side to side in the puddle to prevent the blocking effect, which is produced when the rod is carried in one side of the puddle, as shown at D.

Finishing the end of a seam is illustrated in Figure 11. When reaching the end, start slanting the flame on the side and use only enough of the side of the melting zone to melt

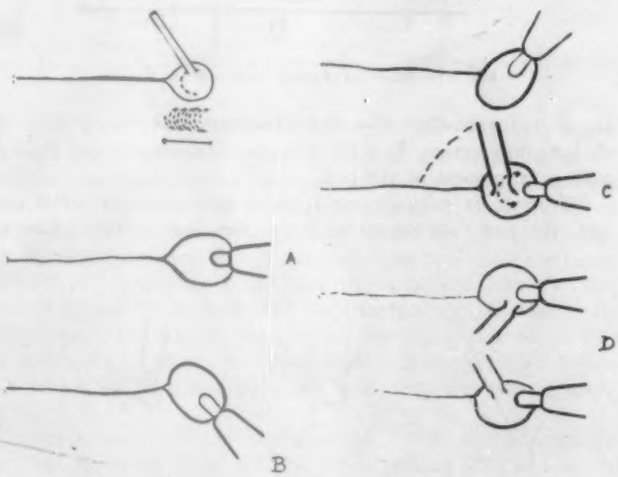


Fig. 10—How Movement of Rod Affects Shape of Puddle.

the puddle to the proper size. If the flame is held too straight against the plate at the finish a hole may be melted through it. The second sketch here shows how to slant the flame when filling a hole, directing the melting zone mostly onto the rod, keeping the edges of the hole barely melting as the rod fuses it.

Figure 12 shows the effect of flame pressure upon the pud-

dle. The making of a weld depends on properly directing the flame pressure. Figure 13 shows, at A, how the heat can be radiated directly back against the torch tip if it is improperly held. B and C indicate how the tip can be slanted so that this does not occur.

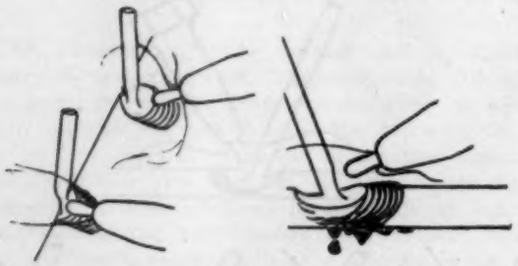


Fig. 11—Finishing Seam and Filling Hole.

Another phase of ripple welding is called the back hand method, recommended where deep penetration is essential or where much filling is necessary. The sketches in Figure 15

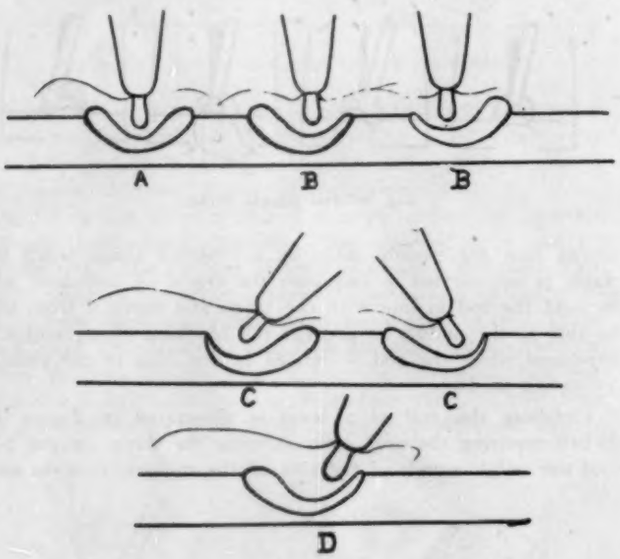


Fig. 12—Effect of Flame Pressure on Puddle.

show, respectively, A— the crescent movement, B— the shaking movement, C— the circular movement, and D— the rolling movement of the rod.

Figure 16 is a ripple weld made with the still torch position, the rod following the flame, the flame slanted forward

Fig. 13—Controlling Heat in Corners.

to the weld and directly over the crack. Figure 17 shows the rod movements for this position. Welding rod is manipulated with the rapid shaking motion to remove its block effect and permit the back rim of the puddle to melt smooth and round. There are cases where the rod movements shown in Figure 15 can be used with the still torch position, but the shaking movement is recommended as the most useful for general practice.

Two methods of vertical welding are shown in Figure 18. In A the rod follows the flame and requires more direct heat because of the blocking and chilling effect of the rod on the puddle. Penetration, however, is easily secured. At B the

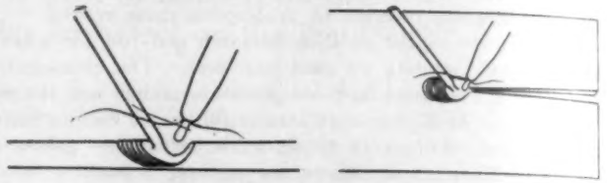


Fig. 14—Rod Following the Torch.

flame follows the rod. The flame is slanted more and more heat is required to control the puddle which is kept from running over by the slanting position of the flame.

Three positions for overhead welding are shown in Figure 19. In all cases the direction of the weld is toward the operator. Figure 20 is a suggestion for overhead pipe welding. Start at A and ripple weld across the bottom of pipe to B,

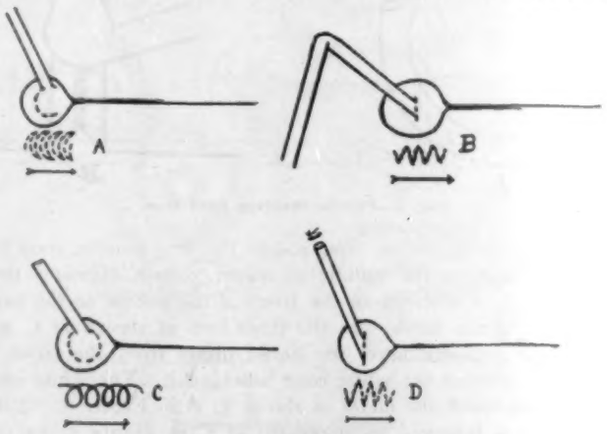


Fig. 15—Various Movements of Rod.

change position and weld from B to C. At B the flame is slanted upward to the plane of welding, not straight against the pipe. This point is the hardest place to keep the puddle from running over the back rim. When C is reached change position and weld the other side of the pipe upward from A

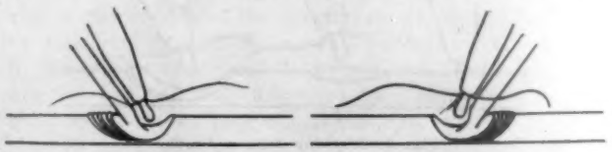


Fig. 16—Still Torch Position.

to C. The lower part of the illustration indicates that the welder has his choice of methods in welding upward on the side of the pipe. That means either that the flame may follow the rod or the rod may follow the flame.

Figure 21 illustrates the positions for horizontal welding.

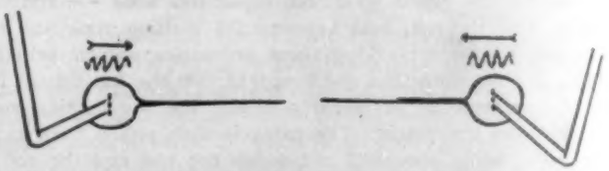


Fig. 17—Rod Movements for Still Torch Position.

The rod is bent so it can be carried in the top back part of the puddle. In this position when shaken rapidly it acts as a chilling and blocking agent on the top of the puddle as well

as a filler and prevents sagging. The flame is slanted upward to the puddle to utilize the pressure in helping to hold the metal up.

This group of illustrations is not intended to cover the subject of torch manipulation completely. The author of these diagrams emphasizes the fact that torch manipulation alone does not produce good welds. Enough of these sketches have

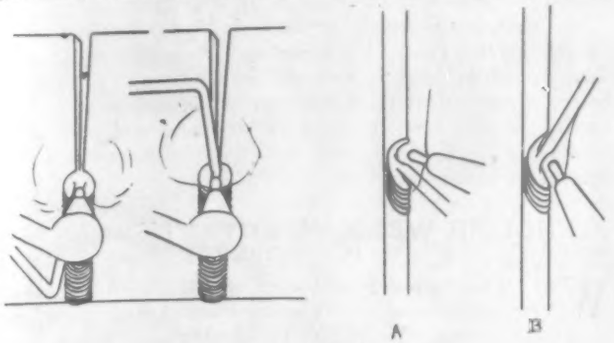


Fig. 18—Vertical Welding.

been selected to show that the apparently nervous motions of the expert welder are made according to a definite plan for each job. The beginner can acquire the same skill in placing metal where he wants it by watching carefully the effect of torch and rod motions on the molten pool.

Fig. 19—Overhead Welding.

SILVER BRAZING ARMATURE COILS

Before the silver brazing process was used, the Illinois Traction System had experienced trouble with the motors used in electric locomotive service on account of the thin solder melting from the armature coils and grounding on the rear head. In heavy locomotive service the motors heat up very often above the melting point of the solder and some method had to be devised to get around this trouble.

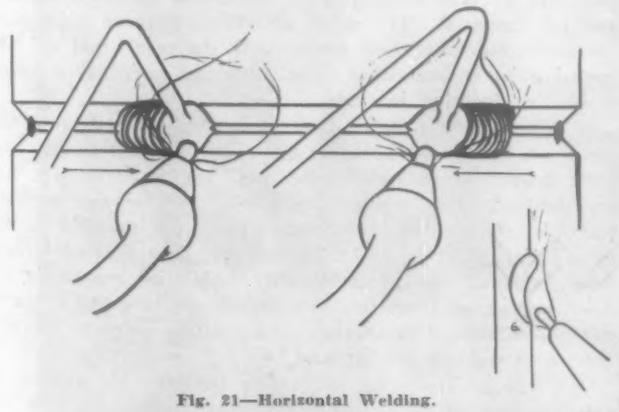


Fig. 21—Horizontal Welding.

It was therefore decided to obtain a General Electric silver brazing machine to use in fastening the bar type coils together. As the cadmium silver alloy used in brazing has a melting point nearly three times higher than the lead and tin solder, no further trouble was experienced after the new process was used.

The silver brazing machine operates at 440 volts A. C. and the same principle is employed as that found in the electric rivet heater.

Preparing Armature for Brazing

Before the silver brazing work was done, the pinion end of the armature head was cut down in a lathe so that the brazing work could be accomplished without interference. When the armature has been assembled and is ready for brazing, it is carried by chain hoist and overhead trolley to rest stands shown in the illustration. These stands are made of cast iron on the top of which are lifting screws with U-shaped seats for the ends of the armature shaft to rest on. The seats are lined with a babbit composition to prevent scoring and the shaft moves on a special brass bearing.

Thin plates of cadmium-silver welding material are placed on each side of coil bar ready to be placed between jaws of brazing

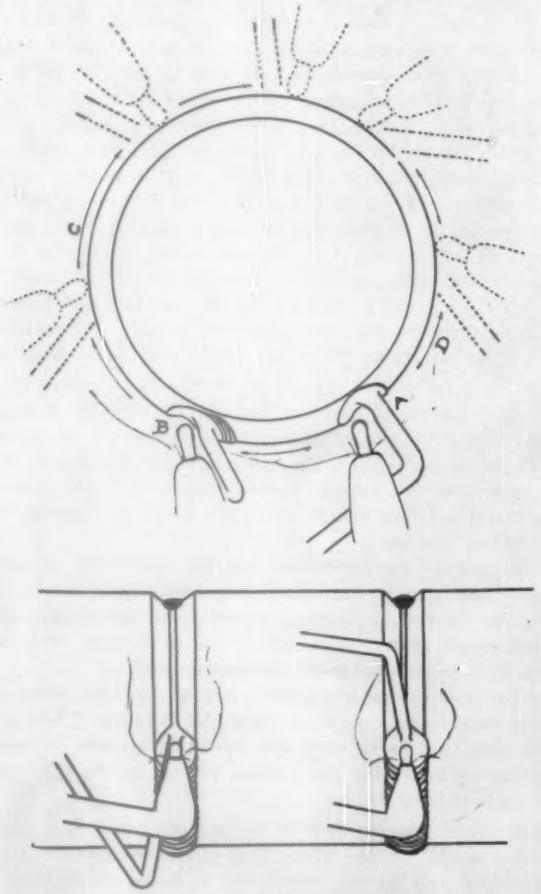


Fig. 20—Overhead Pipe Welding.

machine. Jaws of electric brazing machine are of a carbon and graphite brush composition fastened in V-shaped slots of copper terminals. The tension of the jaws is adjustable by means of the screw and spring arrangement shown at the top of the machine. Levers at the back and on the side of the machine make the heater movable in a horizontal plane. The vertical adjustments are taken care of by the screws on top of the armature stands. Due to the intense heat, the copper terminals of the jaws have to be built up with a welder after every six armatures have been brazed while the carbon elements are good for four armature brazing operations.

Silver brazing is used only on G. E. 69 C. motor armatures as they have bar type coils. The silver brazing process can only be used on coils of this type. The motor has a 200 horse power rating.

Another advantage with the silver brazing process is that if a top bar coil is grounded and a repair has to be made, it can be heated in the electric brazing machine and lifted out for renewal.

In connection with the silver brazing process, this shop uses a pneumatic riveting machine for cutting out the copper coil leads from a commutator. Instead of the riveting device, a chisel is placed in the chuck.

—Electric Traction, June 1, 1926.

WELDED FACTORY

Following closely upon the heels of the construction of the first commercially sold office and store building to employ arc welding throughout fabrication and erection of the steel members, announcements has just been made of the completion of an important factory unit in which not a single rivet was employed.

The extent to which the welding process is coming into use is illustrated by the fact that the commercial building was erected hundreds of miles from the factory building and by entirely different interests. The commercial building was erected at Canton, Ohio, while the industrial building was put up for the Pearl City Boiler and Manufacturing Company at Jamestown, New York.

There were only two elements in common in connection with these widely separated jobs. In both instances, the joining for the structure was accomplished through the use of the portable Stable-Arc Welders, manufactured by the Lincoln Electric Co. of Cleveland. In both cases, the firms, instrumental in bringing about the use of welding in place of rivets on the structural jobs, has had long experience with arc welding on other work.

The steel for the Canton building was fabricated and joined on the job by the Morgan Engineering Company, which had used welding in connection with locomotive repair, production of gear boxes and for some structural connections over a period of a number of years. The owners, in the case of the Jamestown industrial structure, have been making notable accomplishments with welding on stacks, boats and other jobs over a long period of time.

All structural steel members for the Pearl City Boiler and Manufacturing Company building at Jamestown were fabricated through the use of welding, the same machines having been used as are employed on the average run of shop work. All connections for the steel columns and beams were joined in erection by the same welding process.

In the case of the Jamestown job, the application of welding has taken one step further than on previous undertakings. According to George J. Graves, president of the manufacturing company, every single connection in the plant was welded, thus making the structure completely welded throughout.

"For the past twelve years, our company has been using welding on a great variety of work," says Mr. Graves. "Thus, when it came time for us to erect our new factory unit, it was but logical for us to employ the welding process to the job in place of the older riveting method.

"As has been demonstrated to us time and again in connection with other work, the use of welding on the connections for the new building resulted in materially reducing fabricating and erection costs. At the same time we were enabled to construct a much stronger building than would have been possible had any other method of joining been followed."

Prior to erecting its own building, the Pearl City Boiler and Manufacturing Company has had extensive experience with welding on other structural work. In the home city of Jamestown alone the firm has erected a twenty-five-ton elevator shaft, running for five floors, without the use of a single riveted connection, and with all joints welded. Although in use for over two years, this shaft is now giving one hundred per cent service, without having had a single bit of repair.

During the last four years, the Jamestown Company has fabricated and erected on an average of ten welded smoke stacks per year. These have ranged all of the way from nine to forty-two inches in diameter and from fifty to one hundred ten feet in height. Steel employed for the work was run from sixteen gauge sheets to three-sixteenths-inch plate.

The work done by the firm in construction of boats demonstrates the great strength which is attainable with welded joints. Early in March of 1923, the Pearl City Boiler and Manufacturing Company completed a ferry boat sixty feet long and fifteen feet wide, which has since been operating constantly on Lake Chautauqua from Bemue Point. All connections for the quarter-inch plate in the fourteen-and-one-half-ton boat were made by the use of welding. It is stated that the job has proven entirely satisfactory and at no time has there been any trouble in the welded connections.

During 1924, the same company built a house boat, thirty-five feet by sixteen feet with three-sixteenth-inch plate and all connections welded. Although this job has been put to the most severe tests possible, there has not been a single instance of the welded connections giving away, according to Mr. Graves.

So thoroughly convinced of the desirability of welding are the officials of the Pearl City Boiler and Manufacturing Company, that they predict that it will only be a matter of a short time before all new structural connections will be made with it. They look to the time when the rivets on structural steel work will be as much a thing of the past as is the oil lamp today for the lighting of homes or stores.

ENGLISH WELDING ADVERTISEMENTS

By P. L. ROBERTS

WELDING is widely and intelligently applied in England. New applications of the process are of daily occurrence, with the happiest results of economical manufacture, and—as time tells—satisfactory service. Tanks, high pressure vessels and similar products for holding oil, water, acids, gases, and solids are made in enormous quantities. There is not a metal industry that does not know welding in some form.

Manufacturers of products which can be welded or jointed in some other way have had to choose welding, willy nilly, or they cannot hold their end up against competitors who are *welding* the same products. Despite this, and the fact that they are convinced by careful testing and inspection, but most of all by satisfactory service, that welding, if handled properly, is the best method of jointing, manufacturers here do not make a song about their welding. Why? Because there are many conservative users who dearly like to see a few bolts or rivets in the goods they buy, "You know, just to make sure it's safe!" It is even known for buyers to refuse the offer of manufacturers to reduce the price of an article 25 per cent if they will have it welded instead of riveted! That is why there is an absence of advertisements of welded products amongst the collection of English welding advertisements which are shown here, and are characteristic. It will be noticed that the advertisements are for welding plants and electrodes principally. These people *know* the reliability and economical value of welding and are not afraid to stress all the advantages of welding in their advertisements. Manufacturers of plants know that all the claims to economy of the process can readily be demonstrated, and instances of satisfactory service for other customers quoted and substantiated. The other advertisers have an equal confidence in booming their goods, with the result that the advertising is enthusiastic. The clippings were taken from various engineering journals.

It will no doubt be of interest to American welding engineers to note that electrodes are made for welding stainless steel, copper, brass and bronze, and that the Admiralty use arc welding. Other points of interest are the use of oxy-acetylene for cutting cast iron, and that a portable A. C. arc welding plant is used. Though only one firm advertises their display at the great Wembly Exhibition practically all the firms whose advertisements are shown here had a stand at the exhibition. Prominent publicity was given at the exhibition to welding in that way.

The type of firm who will repair anything by welding is well represented in the center of the page. The use of American-made welders in England will be of further interest to American readers, and the use of some of their well-known and high quality electrodes.

Greater publicity is given in England every month to welding, and those who have not availed themselves of the immense advantages of the process, because of prejudice or conservatism, are feeling they must do so or get left behind.

(See group of typical advertisements on opposite page.)

A.W.P. Weldi
As supplie
ADMIRA
for
H.M. DOCK
INDI
AS
SOUTH AFRICAN
RAILWAYS.
THE CONSOLIDATED PNEUMATIC TOOL CO., LTD.
WORKS MANAGER: "There isn't A LOT TO MAKE, WILLIAM?"
FOREMAN: "Yes, Sir; couldn't we WELD THEM?"
WORKS MANAGER: "I am not sure—I will find out sometime or other."
"Sometime or other" is usually "Never." We can help you to solve your problems and tell you the best way to weld the job. Send a sample now and ask. It will cost you nothing.
We specialise in ARC-WELDING PLANTS, ELECTRODES, Butt, Spot and Seam WELDERS, ETC., ETC.
WELD IT
Use A.W.P. Electrodes
The choice of discriminating Engineers
ALLOY WELDING PROCESSES LTD.
14-16 CHURCH STREET, LONDON, N. 1.
CAR GOLF
WELD IT!
RESWELL
ENGINEERING & WELDER Co Ltd
BRADFORD.
WELDING at WEMBLEY
THE PREMIER ELECTRIC WELDING Co. LTD.
ABBEY WOOD, LONDON, S.E.2.
BARIMAR
14-18, Lamb's Conduit Street, London, W.C.1.
Allen-Liversidge, Ltd.
The "ALTEKNARC" ARC WELDING MACHINE
Supplied in Seven Sizes for Arc Welding and Cutting.
ELECTRIC
ARC WELDING
Recent developments open up new possibilities in Electric Arc Welding. Probably you can profit by them.
METROPOLITAN-VICKERS
ELECTRICAL Co Ltd TRAFFORD PARK, MANCHESTER
Points that c
in
WHITECROSS-A
ELECTRODE
THE WHITECROSS COMPANY LIMITED WARRINGTON
A-L LINCOLN ELECTRIC ARC WELDERS.
Allen-Liversidge Ltd.

Advertisements of the Process are Plentiful in England, but Users Are Not Giving Much Publicity to the Welded Product.

Welding Structural Steel

Results of Tests Made on Structures Made by Riveting and Structures of Identical Design Made by Welding

By K. Haas*

HARDLY a week goes by without at least one publication of a story about welding of structural steel.

The general interest in this subject and, on the other hand, its importance, are thus clearly demonstrated. Nevertheless, we have to admit that welding of structural steel is still in its infancy and it will take considerable time and effort before it will be generally accepted. During this time of development it is important to publish all reliable data obtained by tests and experimental work, thereby maintaining the interest of all who are concerned, and thus increasing the rate of progress. We do not claim that the tests made, in

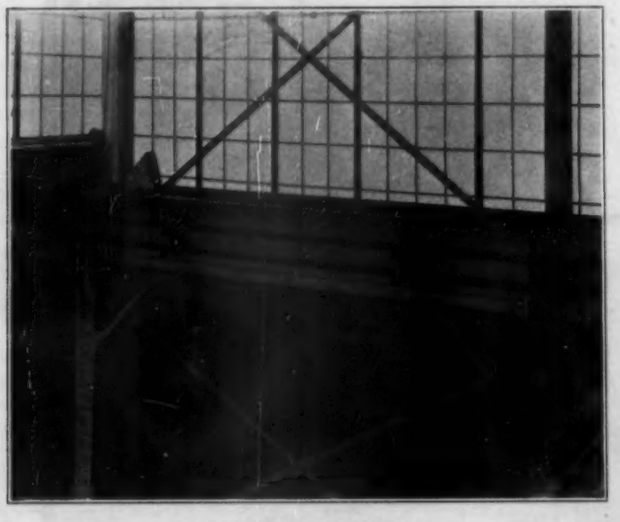


Fig. 1—All Welded Girder.

cooperation, by The Austin Company and the Una Welding & Bonding Company are complete, or anywhere nearly complete. What we want to make known is, mainly, that The Austin Company on the one hand, and the Una welders on the other, are doing research work in order to find out whether —and if so, how, rivets can be replaced by welding.

The following pieces were designed and prepared by The Austin Company and welded in our plant:

1 35-ft. Span Truss, made exclusively for experimental purposes, to get data in comparison with riveted trusses.

1 Girder, for a 50-T. Crane Runway.

1 Column Supporting a 5-T. Crane, a 15-T. Crane and one side of two Roof Trusses.

The girder and the column are in service in the plant of the Pittsburgh Transformer Company. (See Figures 1 and 2.) The design of all three parts was the same as for riveting. For the girder and the column the reasons are obvious: The Austin Company could not very well install parts of different design in a building consisting of standard parts. The same design was chosen for the welded truss as for the riveted one, for the simple reason that it was desired to have the same conditions in both cases, excepting that the rivets were replaced by welds. The fact that the design of a riveted truss was used for the welded truss also makes it impossible, from the very beginning, to obtain general cost data of welding, as compared to riveting. The greatest advantage of welding against riveting is the possibility of simplifying the design by doing away with all gusset plates, connecting angles, etc. To what extent the steel mills will have to bring out new structural shapes adapted to welding, rather than to riveting, will be decided in the future.

The basic figure for the design of the welds was: 10,000 lbs. per sq. in. working shear through minimum longitudinal section of weld. As these welds actually possess a shearing strength of at least 40,000 lbs., the factor safety was at least 4. Since, however, it was thought undesirable to make any welds shorter than one inch, the actual inches of weld put on were considerably higher than obtained by this calculation. In *addition*, the craters were not measured.

In order to obtain as much information as possible two different welding methods—carbon arc and metal arc, were

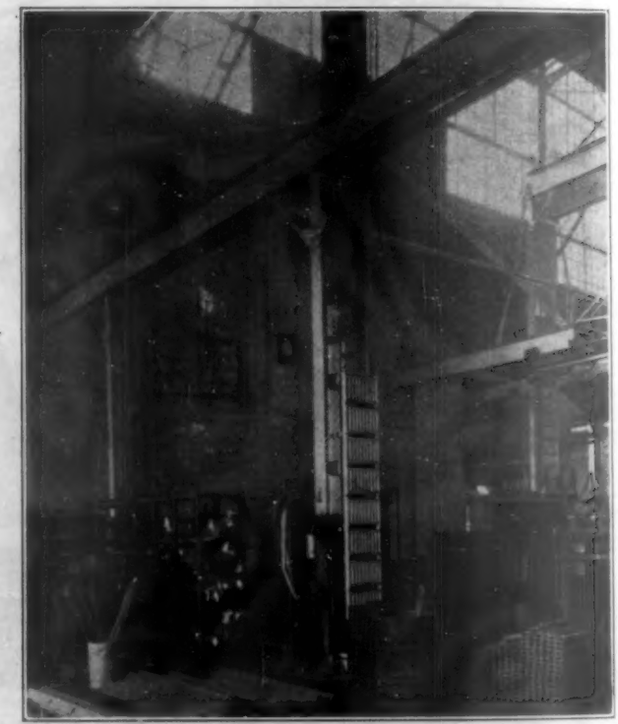


Fig. 2—All Welded Column.

used on the truss, while the column and the girder were welded entirely by the carbon arc. Some seams were double-welded, or UNA-fied, in order to get information as to whether we would be able to obtain the same good results, by this process, in the welding of structural steel as in the welding of rail joints.

The following data for welding speed were found in all preliminary work: We found that a very convenient rate of travel for the carbon arc welder is about 6" per minute, single weld, or 3" per minute, double weld. The metal arc welder travels about 3½" single weld and 1¾" double weld. These speed data mean actual arc-striking time and do not

*Welding Engineer, Una Welding & Bonding Co.

include any time for changing electrodes, etc. On the other hand, these figures are very conservative and are obtained without the use of very high currents.

In the actual welding of the truss the welders made almost exactly one-half this speed. In this case, however, the time for changing electrodes, tacking, etc., is included, which means that the time efficiency of the welders was 50 per cent. In these figures the time for assembling and occasional turning around was not taken into consideration. On account of the particular conditions in our plant at the time when these welds were made, the time used for these purposes was excessive and cannot be included without destroying the whole picture.

All welds were made on ¼" steel angles. The blue-print called for a weld section as shown in Figure 3, in the shape of a triangle, with side lengths of ¼" and ⅜", respectively. It may not be customary to make the one side of this triangle longer than the other. We accepted this scheme in order to increase the shearing cross-section without considerable increase in welding time. In addition, this particular shape of the seam has the great advantage of almost compelling the welder to obtain good penetration to the plate, which means, to the piece of higher heat capacity. In fact, the

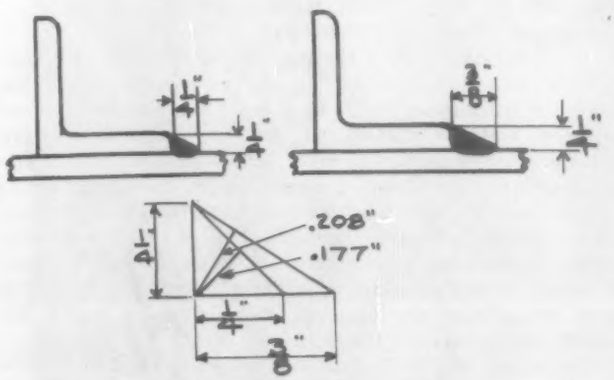


Fig. 3—Cross Section of Welds.

welds came out stronger than called for in the blue-print, so that, taking everything into consideration, the factor of safety was considerably higher than 4.

The following conclusions were reached about the adaptability of carbon arc and metal arc welding for this kind of work: On heavy sections the carbon arc has the great advantage of considerably higher speed than the metal arc, the ratio being about two to one. The disadvantage of the carbon arc is, mainly, that it cannot very well be used for vertical or overhead welding. We use, therefore, the metal arc for tacking and for all vertical and overhead welding, and the carbon arc for all flat work which, in a production process, should represent by far the greatest part of the work. Some difficulty was encountered in keeping the parts straight when long welds had to be applied. Making use of the well-known methods explained in almost every welding book, we soon developed a procedure which enabled us to keep the girder and column from warping and twisting, so that, by the time they were completed, they were straight within a small fraction of an inch.

As mentioned before, the girder and column could not be subjected to any destructive tests, since they were installed in actual service. After one year of service they are in perfect condition. No signs of stresses or failures can be detected and we expect them to stand up in the future. The welded truss, together with one riveted truss, were tested to destruction by gradually applying an even load consisting of I-beams. (See Figure 4.) The riveted and welded truss failed at the same time. As can be seen from Figures 5 and 6, the welds and rivets were not affected. The load applied was 2½ times normal. The Austin Company explains the failure as follows: The detail design of the end gusset plates in both the welded and riveted trusses was superior to the details commonly used in general fabricating practice for wall-bearing trusses. Notwithstanding this fact, the failure in both trusses was due to the inadequacy of the detail of the end-gusset plates. The Austin Company previously tested

Fig. 4—Trusses Under Load.

riveted versus bolted trusses. In that case, failure occurred from the same cause also. Although the detail of the end-gusset plates in the riveted and welded trusses tested together was improved over the similar detail in the riveted and bolted trusses tested together, this detail was found inadequate to destroy either the welding or riveting.

As far as the welded truss is concerned, we are absolutely confident that the welds would not fail. All that is necessary to make a welded joint a perfect joint is good engineering. Good engineering means that proper equipment be chosen, that good materials be used, that the design be correct, and that the welding itself be done and supervised intelligently.

Fig. 5—Failure of Riveted Truss.

Much has been said lately about the "human element" as an uncertain factor in welding. We think that most of this is greatly exaggerated. If conditions are right a welder can hardly fail to make a good weld—at least not in such a way that it could not readily be detected by visual examination.

To my knowledge, there are but three points in which the welder could miss doing his work properly. These three points are: Lack of penetration, poor welded metal on account of long arc, and lastly, depositing metal in a wrong position. I claim that all of these three mistakes can easily be avoided by proper supervision. Lack of penetration will never occur as long as the welder is made to use sufficient current. With sufficient current he simply cannot avoid burning into the base metal—excepting rare cases where very

Fig. 6—Failure of Welded Truss.

thin sections are welded to very heavy ones. The danger of using a long arc is by far not so pronounced as has been stated in many publications. Anyone who has ever done any welding is familiar with the fact that it is much more difficult to hold a long arc instead of a somewhat shorter one. Every welder is naturally inclined to hold the arc as it is most convenient for him. It is simply the task of the welding engineer to provide for a machine and electrodes which make the arc length both easy and convenient to hold and correct for obtaining the best results. In addition, poor welds caused by excessive arc length can readily be recognized as such, and the arc length can always be checked during the welding operation by means of a volt-meter.

To summarize briefly what we have learned from our experiments in the welding of structural steel:

1. It is entirely possible to make arc welded joints of structural steel of sufficient strength.
2. On heavy sections carbon arc welding is more economical than metal arc welding for flat work, the physical properties of the weld metal being about the same.
3. The design of the structure has to be changed before arc welding can compete with modern high speed riveting methods.

C. G. M. A. MEETING ATTENDED BY 250

The Fourteenth Annual Meeting of the Compressed Gas Manufacturers' Association was held at the Hotel Commodore, Monday, January 24, 1927. The members were welcomed by Mr. John C. Minor, first vice-president of the Association. Following Mr. Minor's greeting Colonel B. W. Dunn, chief inspector of the Bureau of Explosives spoke. He emphasized the value and need of collective thought in guiding the activities of an industry, particularly in connection with the solution of such problems as are involved in insuring the use of safe and efficient equipment for handling compressed gases.

Colonel Dunn mentioned the change of thought which has resulted in the development of ideals of service on the part of industry and the conviction on the part of governmental agencies that in general it is best for the government to keep out of business.

The agencies which make it possible for business interests to collaborate in their efforts to progress in establishing the most satisfactory trade conditions were likened to a satisfactory designed harness to harmonize their efforts. The facilities of the Association afford the means by which individual gas manufacturers are enabled to help in establishing the desirable results.

A paper on the changes in gas cylinder steels, prepared by Mr. K. G. Jobson of the Union Carbide and Carbon Research Laboratories, was read by Mr. J. J. Murphy and was followed by discussion on various phases of gas cylinder manufacture and maintenance.

Dr. I. C. Gardner of the Bureau of Standards described some optical methods of inspecting pressure vessels.

Mr. F. A. Ernst of the Fixed Nitrogen Research Laboratory talked on the technique of handling gases under high pressure and described various pieces of equipment designed for very high pressure work. These included pressure relief valves, unions, compressor valves and pipe line valves and joints. Illustrations and exhibits made the description clear and much interect in the subject was expressed in discussions. The influence of carbon dioxide on plant growth was the subject of a paper by Mr. J. M. Arthur of the Boyce Thompson Institute for Plant Research and Mr. R. S. McBride, associate editor of Chemical and Metallurgical Engineering spoke on "Progress in the Compressed Gas Industry—Converting Dreams to Dividends."

The presentation of these papers was followed by a business meeting during which reports were received from the various committes of the Association. The activities reported included matters relating to the oxy-acetylene industry. Among those of particular interest may be mentioned: securing approval for the use of larger welded cylinders, painting of gas cylinders, colors for welding hose, precautions in shipping acetylene cylinders, standardization of gas cylinder valve outlet connections, measurement of gases under high pressure, and testing of acetylene cylinder filler. A great deal of work on cylinder specifications and methods of testing was carried on throughout the year.

The report of the Transportation Committee and Legislation Committee showed that a mass of tariff and legislative matter was reviewed and satisfactorily disposed of during 1926.

The following officers were elected for the current year:

John C. Minor, President.
H. S. Smith, First Vice-President.
P. Samuel Rigney, Second Vice-President.
John H. Luening, Secretary-Treasurer.

The Fourteenth Annual Banquet of the Association followed the meeting and afforded to some two hundred and fifty members of the industry opportunity of friendly talks under most delightful circumstances.

CANADIAN BRANCH OF AMERICAN WELDING SOCIETY FORMED

A group of about ninety men in Montreal and vicinity who are interested in the promotion of the welding industry recently held a meeting at Magill University for the purpose of organizing a Canadian branch of the American Welding Society. The first meeting resulted in signing up nearly a hundred members and electing a group of officers to serve while definite organization plans were being carried through.

BISSELL TALKS TO LOS ANGELES SECTION

At a special meeting of the American Welding Society, Los Angeles Section, to be held on Friday, February 18th, Mr. A. G. Bissell of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania, is scheduled to give an illustrated talk on arc welded structures. Mr. Bissell has addressed a number of the Sections of the Society on this subject and always has for them a great fund of valuable data on the usefulness of welding in the fabrication of all-metal structures.

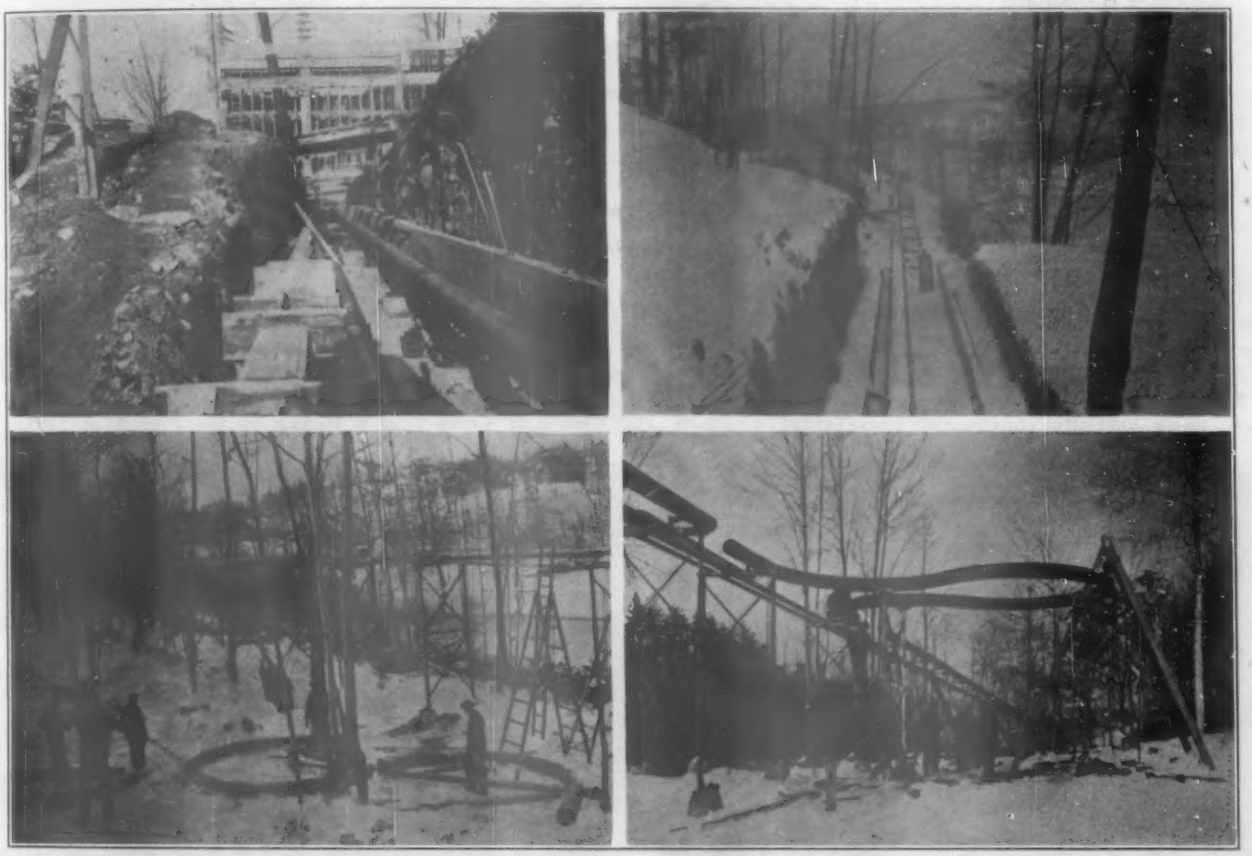
Welded Steam Pipe Line

Some Details of the Construction of a 10-Inch Low Pressure Steam Line, 1200 Feet Long, Including Three Expansion Bends

By A. W. Birnie

OXY-ACETYLENE welding played an important part in the construction of a pipe line which was recently completed at Fitchburg, Massachusetts by the Parks-Cramer Company of that city. A 10" low-pressure steam line was installed from one of the paper mills owned by Crocker, Burbank Company to a new building now under construction.

The distance between the buildings is 1,045 feet and three expansion bends in the line being the total length of pipe to approximately 1,200 feet.



Above—Pipe in Trench at New Mill. End of Trench, Showing Part of First Bend.
Below—Assembling Second Bend—Erecting Framework Under Third Bend (Two Welds Can Be Seen on This Bend.)

Starting at the new mill the pipe runs underground in a concrete trench for about 150 feet. The balance of the line is in the open along the bank of the Nashua River and is supported on steel framework set on concrete piers 15 feet apart, the framework gradually reaching a height of 18 feet on account of low ground.

At each steel support a cast iron roll set in brackets is placed to take care of the line movement during expansion and contraction.

All joints in this line were butt welded. Angle irons were placed along the top of the framework for a track on which small trucks carried length of pipe into position for welding. The ends of the pipe, which had previously been scarfed, were placed $\frac{1}{16}$" apart and tacked in three places. Roll welds were made to join the pipe in sections of two lengths each, which were then jacked up and a specially constructed chair slipped under the pipe at each roll on the framework. As the work, with the exception of that in the trench, was done on top of the framework it would have been too difficult to handle longer sections in this manner. As each section was placed on the chairs it was tied into the main line and the chair legs were then welded to the pipe.

Three expansion bends were placed at equal distances along the line. Anchors were also placed near each end of the line and half way between each bend, to control the direction of the line when expanding. These anchors were fastened to the framework and strapped and tack welded to the pipe, then stayed to the concrete piers.

Work was started at the new mill and progressed as above described to within one length of pipe from the first expansion bend. Then a start was made at the anchor beyond the bend and the line constructed back to within one pipe length of the bend, but this anchor was not fastened to the pipe until the bend was tied into line.

The bend was made in three sections which were welded together to form one unit and a length of pipe was then welded to each end. The bend was spread 6" with a jack, lined up with the main line, clamped in position and tacked.

The ends of the bend were also chained in position to keep the alignment until welding was completed. The anchor was then fastened into place and the jack removed from the bend.

The second and third bends were assembled in the same manner, but the main framework having reached 18 feet in height, the work was done on the ground and the bends were raised and their framework erected under them.

ing paper and one thickness of 3-ply roofing paper. The final layer consisted of roofing paper fastened on with copper wire and all joints cemented.

This line is the first of its kind to be completed in this locality, and as special efforts were made to keep the line straight it presents a very neat appearance.

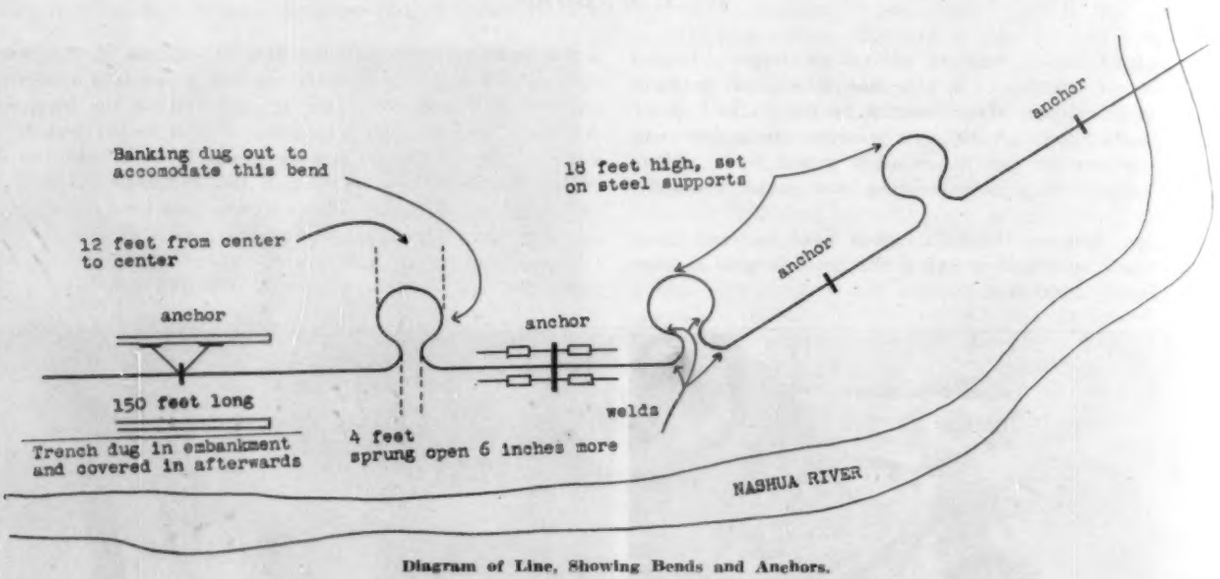


Diagram of Line, Showing Bends and Anchors.

The four welds at the bends were well reinforced. When the line reaches full expansion (about 26") the bends will come back to their normal position or more, according to the temperature at the steam pressure used.

Just before entering the boiler house the line crosses the river on a specially constructed steel bridge which is 25

Framework, Showing Part of Bridge Across River.

feet above the surface of the water. As this bridge has overhead steelwork it was possible to handle a long section with chain falls, so several lengths of pipe were roll welded and the whole section raised on to the chairs and tied in.

Three tests were made during the construction of the line so that the covering could be applied as the work progressed. Two cold water tests were made at 170 lbs. pressure. On account of extremely cold weather the third test was made with air and ether, the pressure being raised to 88 lbs. and held for over twenty-four hours, but in each test the joints were found to be perfectly tight.

The entire pipe line out of doors was covered with two 1½" thicknesses of 85% magnesia sectional covering, all joints being broken and pointed, two thicknesses of build-

AUTOMATIC WELDING THE SUBJECT AT CHICAGO FEBRUARY MEETING

At the February meeting of the American Welding Society, Chicago Section, which was held Friday evening, February 4th, Mr. J. C. Lincoln of the Lincoln Electric Company, Cleveland, Ohio, gave a lecture on the subject of automatic arc welding. In this lecture he explained the principles of automatic welding with the carbon arc and illustrated the procedure by diagrams drawn on the blackboard. This was followed by the showing of a motion picture reel which was taken during the construction of an all arc welded two-story building. Mr. Lincoln also gave a short and interesting talk on the nature of the metallic arc, based on some experimental work done in the laboratories of the Lincoln Electric Company at Cleveland.

NEW DEPARTMENT OF COMMERCE BOOKLET ON SIMPLIFIED PRACTICE

The Division of Simplified Practice of the Department of Commerce has recently issued a booklet which concerns wrought iron and wrought steel pipe valves and fittings. It gives a list of the organizations which comprise the membership of the national committee on metals utilization and a list of the associations and corporations who have accepted the recommendations for simplified practice and also tables of specifications covered in these recommendations.

WELDING AIDS CONSTRUCTION OF X-RAY ROOM

In building the new Tampa Hospital at Davis Island, Tampa, Florida, the workmen had reached the place where they were ready to line the walls of the X-ray rooms with lead. Not everyone knows that lead is the only inexpensive metal which will absorb the powerful X-rays and that every room in which very much X-ray work is done must be so constructed that the radiation cannot go beyond the walls of the room because there is considerable likelihood of injury to persons in adjoining rooms if exposed to even a small amount of this radiation for an extended time. The lead used was in thin sheets put on with overlapping seams. It was first fastened to the wall by nails

driven through one inch squares of lead. Then came the problem of closing the seams and covering the nail heads so they would not permit even the slightest leakage. Soldering is a slow and tedious process, so after several attempts had been made that was abandoned. Some local welders attempted to weld the job but

Welding Lead Lining on X-ray Room.

not being skillful in this kind of work did not seem to make satisfactory progress with it. Assistance was secured from the Thermaline Gas Corporation and a skilled welder finished the work at a rapid rate of speed. It is reported that 272½ feet of seams and 803 nail heads were welded in 42 hours by one welder and a helper.

NEW PREST-O-WELDING BLOWPIPE FOR WIDE RANGE SERVICE

The outstanding feature of the new Prest-O-Weld W-101 blowpipe, manufactured and recently offered to the trade through jobbers by the Oxweld Acetylene Company, 30 East 42nd Street, New York City, is that it is designed in such a way that the oxygen and acetylene enter the inlets at about equal pressure. Gases are thoroughly mixed in a simple mixing chamber. The mechanical efficiency of this chamber insures intimate mixing of gases under all working conditions, eliminates waste of gases and saves the time of the operator in maintaining the neutral or working flame. With it economy of gas consumption is claimed.

Of all brass construction, this new welding blowpipe is very simple in design. It is screwed together on metal-to-metal seats, with no soldered or packed joints. Thus any workman can easily disassemble and reassemble it when minor repairs are necessary.

Stems for the W-101 blowpipe are made in three lengths, 4, 9, and 19 inches long, each of which, in turn, is made in three angles, 45, 60 and 90 degrees. By the simple unlocking of one union nut, anyone of these stems can be fitted to the handle part of the blowpipe. This feature greatly increases the adaptability of the blowpipe to the physical peculiarities of the work in hand, and to the preferences of the operator. The over-all lengths of the blowpipe with the different stems are 15, 20 and 30 inches.

The ten interchangeable tips offered with the blowpipe are made to withstand the severe service to which welding tips are usually subjected. Nos. 3 and 4 are made of heavily copper-plated brass, and Nos. 5, 6, 7, 8, 9, 10, 11 and 12 of solid drawn copper. To simplify the work of the operator, the proper oxygen and acetylene pressures to be used are stamped on each tip. Two stems, the 4-inch and 9-inch, 60 degrees angle, and 5 tips, Nos. 4, 6, 8, 10 and 12, are furnished standard with the blowpipe. Any of the others may be had if they are so specified.

The blowpipe is sturdily constructed for the heaviest of service. It is well balanced, the center of gravity being well toward the rear. The handle is knurled, affording a firm grip. The W-101 welding blowpipe, with its low gas consumption, will handle any job from light sheet metal to the heaviest of castings.

The entire W-101 welding outfit complete as offered by Prest-O-Weld includes 1 type R-101 oxygen regulator equipped with 100 lb. and 3,000 lb. gauges; 1 type R-103 acetylene regulator equipped with 30-lb. and 350-lb. gauges; 1—12½ ft. length of ¼ in. green oxygen hose with standard I.A.A. couplings; 1—12½ ft. length of ⅜ in. red acetylene hose with standard couplings; 1 pair of No. 6 fibre goggles, wrenches and an instruction booklet.

The new Prest-O-Weld line also includes the C-101 cutting blowpipe. This sturdy and dependable unit fulfills all the requirements for cutting the lightest to the heaviest sections. It can be had with heads of 75 deg. and 90 deg. angles.

GAS PRODUCTS ASSOCIATION HOLDS SUCCESSFUL MID-WINTER MEETING

The semi-annual meetings of the Gas Products Association have recently been marked by a constantly increasing attendance, and the meeting which was held January 20-21-22 at the Hotel Sherman was no exception. Twice a year the members, who are manufacturers of oxygen, acetylene and oxy-acetylene apparatus, get together for three or four days to discuss common problems and to get the benefit of one another's experience in methods of further developing the oxy-acetylene industry.

Following is a copy of the official program of the meeting:

Thursday, January 20, 1927

10:00 A.M.—Registration
Address of Welcome.....C. O. Frisbie
Roll Call .....A. J. Russell
Why I Come to G. P. A. Conventions
President's Address
Report of Secretary
Report of Treasurer
Report of Committees
12.30 P.M. to 2:00 P.M.—Luncheon
2:00 P.M.—Closed meeting
Price on the Basis of Production Costs.....
.....W. L. Churchill
How to Figure Costs of Production
3:30 P.M.—Open meeting
Address .....Merle Thorpe

Friday, January 21, 1927

10:00 A.M.—Metal Cutting with Oxygen.....Dr. A. Krebs
Schoop Metal Spraying Process.....K. D. Falk
Report on A.S.M.E. Boiler Code.....
.....W. D. Flannery, W. A. Slack
Why Price Is Not the Essential Factor In Getting Business.....
E. F. Dahm, Associate Educational Director, La Salle Extension University
12:30 P.M. to 2:00 P.M.—Luncheon
2:00 P.M.—Showing of G.P.A. Film and Report of Film Committee.....E. L. Mills
8:15 P.M.—Theater Party, Apollo Theater.....
....."The Great Temptations"

Saturday, January 22, 1927

10:00 A.M.—Keeping of Cylinder Records
Collection of Rentals
Charting Territory.....L. M. Zimmer
12:30 P.M. to 2:00 P.M.—Luncheon
2:00 P.M.—Cylinders .....
C. O. Carlson, of Wm. Wharton, Jr. & Co., Inc.
Reports from the Underwriters on New Regula-

tions for the Construction of Oxy-Acetylene Apparatus and Generators.

6:30 P.M.—Informal Dinner and Entertainment, Crystal Room, Sherman Hotel

WELDING SERVICE ACCESSORIES CIRCULAR

Welding Service Company, 50 Church street, New York City, announces that it is carrying in stock a complete line of General Electric welding accessories, including hand shields, helmets, both metallic and carbon electrode holders, etc., for distribution in New York, New Jersey; Connecticut, west of New Haven and Hartford, and Erie County Pennsylvania. A circular has been issued describing the accessories in detail.

NEW ARC WELDING MACHINE MADE OF WELDED STEEL

Among the many interesting developments in the machinery building field is the substitution of welded structural steel in place of gray iron castings. The 1927 300 ampere alternating current power supply Lincoln "Stable-Arc" welder illustrated shows the welded steel idea carried out to its logical conclusion. There are only two gray iron castings weighing about 15 lbs. total on the outfit which have not been replaced with welded steel construction. Other sizes and types are being changed over to the steel construction as rapidly as possible. The motor and generator end rings, brackets and connecting ring are all made of structural angles rolled up into the proper shape and

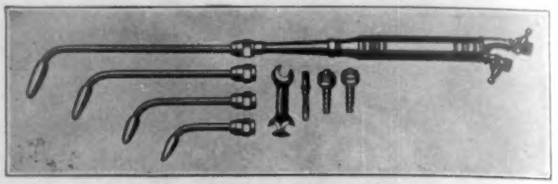
All Welded Motor Generator.

welded together. The feet of the motor generator set are made of drop forgings. The truck wheels are made of T-sections rolled on a special machine. The hub of the wheel is made of steel tube. Control panels are usually made of slate or special non-metallic compounds, but the panel illustrated is made of sheet steel welded together and welded to the supports.

The underlying idea in the application of the principles of welded steel construction to the Lincoln "Stable-Arc" welder was to meet the severe conditions to which portable welding equipment is subjected. Failure in operation of a welding machine is, in many cases, a serious matter. It is claimed that the steel construction, due to the fact that it will bend rather than break, reduces the liability of failure for the reason that the bent parts may be straightened and the equipment put in operation without waiting for replacement castings. In several cases, the control panel has been crushed with instruments and switches wrecked. However, the equipment was repaired by straightening the panel and switches and put into operation within an hour without the instruments.

NEW TORCHWELD NO. 22 NF WELDING TORCH

A new welding torch has just been put on the market by the Torchweld Equipment Company, Chicago, Illinois. This torch is designed to meet the requirements of shops doing either production work or repair work of medium or average size. The torch itself comes equipped with four tips ranging in size from No. 1 to 8, which indicates the range of work for which this new number is designed. In principle it is constructed along



New Torchweld 22NF Torch.

the same lines as other Torchweld torches with the exception that the head and tip are combined in one piece. The length of the head increases with the size of the tip so that as the work is changed from light to heavy the operator's hand is automatically removed further from the heat zone. The price of the torch is $25.00. A complete welding outfit including this torch, two regulators, hose, etc., is supplied at a list price of $75.00.

BILLINGS NEW ADJUSTABLE STRAP CLAMP

The Billings & Spencer Company, General Offices and Works, Hartford, Conn., has just placed on the market a new, adjustable strap clamp.

This universal clamp is designed for holding work on planers, boring mills, drill presses, face plates of lathes and milling machines. Its design permits its use on irregular shapes and various sizes without blocks and shims, holding the work more securely than any other clamp on the market. It also eliminates the usual time required looking for washers, shims, etc.

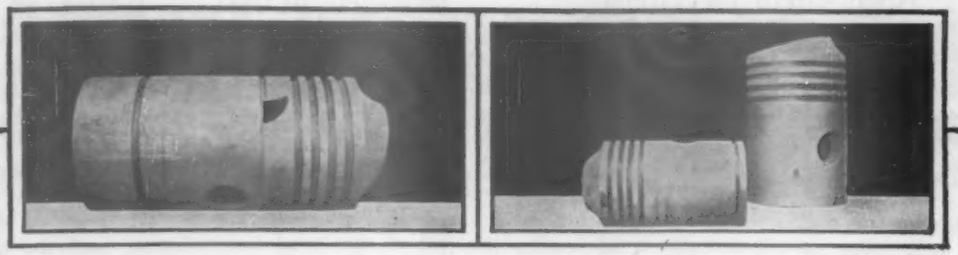
Where the work to be strapped is larger than the capacity of the clamp, all that is necessary is to use a block not greater in height than the piece to be strapped making it unnecessary to use blocking of a definite height, as would be the case with an old style clamp.

No shimming of any kind is required with the Billings Clamp. It has but two working parts to be used in connection with the tie-bolts with which every machine is equipped and, owing to the changeable position of the saddle, tension between T slot of the machine and the saddle (transmitted through the tie bolt) is always at right angles and perpendicular to the table of the machine giving maximum strength.

This tool is proving a great time and labor saver in many machine shops and tool rooms. It is hardened in oil and furnished in this natural finish. Made in three sizes. Full descriptive matter will be sent to anyone mentioning this publication.

FIRST ISSUE OF AUSTRALIAN WELDING ENGINEER APPEARS

The Victorian Institute of Welding Engineers, with headquarters at Melbourne, Australia, has issued the first number of the *Australian Welding Engineer*, dated January 1st, 1927. This new magazine is to be published monthly and devoted entirely to the advancement of all systems of welding in Australia. All communications are to be directed to Mr. A. Stanley Ridley, 440 Little Collins Street, Melbourne, Australia. The first issue contains articles on welding cast iron pipe, on the usefulness of arc welding and on metallurgical considerations. It carries the advertising of about a dozen of the manufacturers and dealers in the industry and shows promise of being of considerable service to them.



"HOORAY FOR TOBIN BRONZE!"

Following is a description by John J. Hilliard, Welder, Fort Worth, Texas, of the welding job illustrated above.

The oil engine pistons cracked in the oil groove—causing the wrist pins to run dry—nuff said. In one case a nice little chunk was broken out, it was in two pieces and was naturally welded first.

The job was handled exactly as if it were to be welded with cast iron. Vee-ed out at a 90° angle almost through the half inch thickness; then put in the furnace and heated just enough to fry spit; it was then laid on its side and the flares were kept going, playing along the lower portions of the casting during the welding.

The Tobin Bronze was spotted, much like a series of tacks, the spaces being divided each time until the final joint was made all over. The purpose of this method was to prevent application of the torch in one section too long.

The welds were built up as little as possible above the surface of the original casting, and the finished job was filed smooth. A small groove was cut by hand and the pistons were ready for use.

With cast iron as a filler, it is almost a certainty that a machining job would have been necessary, besides on account of it being a horizontal job, the castings might have been distorted by their own weight if a safe preheat for that type of welding were used. There were three of these pistons all told.

On the first job I was called at 4:30 P.M. and the job *was finished* ready for installment at 9:30 P.M. the same night. It had to be hauled 14 blocks and was returned wrapped up in calcium chloride sacks.

With a cast iron weld it would have meant a shutdown of at least 12 or 14 hours, besides the possibilities of distortion above mentioned.

The three pistons were repaired and ready for service at an expenditure of 80 cu. ft. oxygen, 80 cu. ft. acetylene, 3 pounds 3/16" Tobin Bronze Rods—9 hours of actual labor. I had one man welding and did my own chiseling and filing. I estimated the cost of the pre-heating fuel at 50c. Figured on percentage my profit was mighty satisfactory. Add to that a more than pleasantly surprised customer, and comparisons with any other methods actually shout "Hooray for Tobin Bronze!"

THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Canadian Mill: ANACONDA AMERICAN BRASS LTD.,
New Toronto, Ontario

TOBIN BRONZE
REG. U. S. PAT. OFF.
WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT

WELDING SHOP LAYOUTS CRAFTSWELD EQUIPMENT CORPORATION ORGANIZED

Craftsweld Equipment Corporation, 570—7th Ave., New York City has just been organized by Charles Kandel, by whom its affairs will be personally directed. The company will specialize in apparatus and engineering service for welding, cutting and industrial gases.

Mr. Kandel is unusually well equipped for this work, having had a thorough engineering training and diversified practice in addition to ten years of wide experience in the oxy-acetylene industry covering the industrial centres of the United States and Europe in which the process is most widely used.

Each item of Craftsweld Equipment has been chosen because of proved merits and is fully guaranteed by a reliable manufacturer, and in addition has the approval of the Underwriters Laboratories and the New York Fire Department.

NEW TORCHWELD CATALOG

The Torchweld Equipment Company, 224 North Carpenter Street, Chicago, Illinois, manufacturers of oxy-acetylene welding and cutting equipment have just issued a new thirty-two page catalog covering their complete line. The new catalog is of pocket size with the cover in three colors, following the same color scheme as is used in their large catalog. The text of the catalog is condensed from the larger catalog so as to give as nearly as possible a complete description of the Torchweld line and at the same time have it convenient in size.

J. M. CAMERON NOW ASSOCIATED WITH IMPERIAL BRASS

Mr. J. M. Cameron, formerly Secretary of the Gas Products Association, recently resigned that position to accept a new connection with the Imperial Brass Manufacturing Company, Chicago, Illinois, manufacturers of a complete line of oxy-acetylene welding and cutting equipment. Previous to his connection as Secretary of the Gas Products Association Mr. Cameron was associated with the Torchweld Equipment Company, Chicago, Ill.

U. S. L. ANNOUNCES NEW MODEL

A circular published by the U. S. Light and Heat Corporation, Niagara Falls, New York, announces a new 200 ampere U. S. L. electric arc welder called the frontier model. The features claimed for the new machine are simple operation and heat control, wide range of heat, self contained and separate excitation, a large number of current adjustment steps, ease of arc manipulation and economical operation. The heat range is from 50 to 225 amperes or 80 to 350 amperes.

A. W. S. BULLETINS AVAILABLE

Mr. C. J. Holslag of the Electric Arc Cutting and Welding Company, 152 Jelliff Avenue, Newark, New Jersey, writes that he has a number of copies each of Bulletins No. 5 and 6 of the American Welding Society which he will be glad to send to parties interested in them. Bulletin No. 5 is a report of the committee on welded pressure vessels and contains a considerable amount of test data compiled by the committee. Bulletin No. 6 is on the subject of the applications of arc welding to ship construction. This is a large sized bulletin containing a considerable volume of designs and illustrations of the great variety of welding carried on in shipyard work.

MILBURN ISSUES NEW MINIATURE CATALOG

The Alexander Milburn Company, Baltimore, Maryland, has just published a new edition of their vest pocket catalog of oxy-acetylene welding and cutting equipment and acetylene generators. Due to additions which have been made to the Milburn line the new edition of the miniature catalog is more comprehensive than previous ones.

STUART PLUMLEY BECOMES SECRETARY OF G. P. A.

Effective February 1st, Mr. Stuart Plumley, formerly Editor of the Acetylene Journal, has been appointed Secretary and Treasurer of the Gas Products Association, Chicago. Mr. Plumley has been editor of the Acetylene Journal for several years and previous to that time had a wide experience in the oxy-acetylene industry, in business, in editorial work and also in engineering departments. He therefore brings to the Association the broad knowledge of both the technical and commercial sides of the industry in which the members are engaged.

K-G MOVES TO NEW QUARTERS

The K-G Welding and Cutting Company now located at 556 W. 34th Street, New York City, will move about February 21st to new and more spacious quarters at 513½ to 515 West Twenty-ninth Street. In their new location they will be provided with two complete floors with light on all four sides, with sufficient space to provide better working facilities for the complete plant and office force. Officials of the company state that these enlarged facilities are made necessary by increased business and that during the moving period arrangements have been made so that service and sales will be uninterrupted.

MATTICE ISSUES NEW WELDING CIRCULAR

The Mattice Engineering Company, Philadelphia, Pa. have recently issued a six page circular which covers quite a range of interesting subjects. Diagrams and illustrations are used to explain some of the principles of electric welding and a number of illustrations of actual repair jobs are shown to indicate the range of work which the process is able to handle. The circular also describes and illustrates the Mattice electric welding generator and a complete line of welding wire and welding accessories.

NEWS OF THE WELDING TRADE

Mayer Lederer has become associated with the Welding Service Company, 50 Church street, New York City, in the capacity of salesman.

According to Mr. S. B. Clapp, sales director of the Treco Welding Appliance Division of the Truck Equipment Company, Buffalo, New York, this company is planning to engage several district representatives during the year who will take charge of direct sales on the Treco semi-automatic electrode feed machines and welding accessories.

At the February meeting of the Institution of Welding Engineers, London, England, which was held on Wednesday, February 9th, Mr. P. L. Roberts of the Metropolitan Vicars Company presented an illustrated lecture on the subject of welding cast iron.

Mr. H. H. Norton, who has been selling welding equipment in Birmingham, Alabama, for the past eight years, has recently taken charge of the welding department of the Moore and Handley Hardware Company of that city.

The Goodman Electric Machinery Company, Newark, New Jersey, who specialize in the sale of electric arc and resistance welding equipment, have issued a new stock list dated February, 1927. This stock list includes electric arc welders of the motor generator type and spot welders, both new and rebuilt.

Mr. David Bartlett, who has been selling oxy-acetylene equipment for the Bastian-Blessing Company of Chicago for the past three years, recently formed a partnership with Mr. C. F. Weimer, Milwaukee, Wisconsin, which is to be known as the Weimer Welding Supply Company. They will act as Rego distributors in Milwaukee and also carry a complete line of accessories and supplies.

Wodack Grinders Are Time Savers

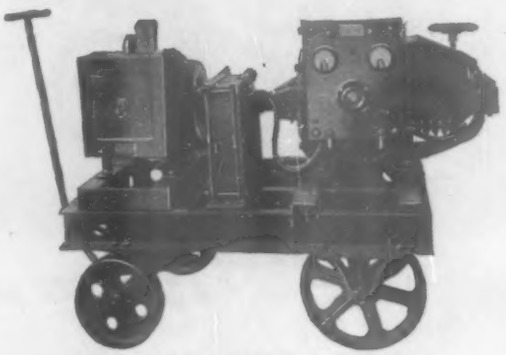
Large plants and small plants use the WODACK Portable Electric Grinder because it saves time and labor. You can use it wherever there's a light socket. (It works on both A. C. and D. C. power.) And there is work for a WODACK wherever there is a welder. Get the particulars about this grinder.

Wodack Electric Tool Corporation

43 S. JEFFERSON ST. CHICAGO, ILL.

Prices below Value

on New G. E. Arc Welders



Generator wound 75/300 amperes, 40/20 volts, Motors wound 10 H.P., 220 volts, 3 phase, 60 cycles, also 220 volts, direct current.

WELDING SERVICE CO. 50 Church St. New York

"All Kinds of Good Welding Supplies Stocked"

Classified Ads

Help Wanted—75c per line, minimum 4 lines.

Jobs Wanted—4 lines free.

Other Ads—$1.00 per line, minimum 4 lines.

Counted 8 words to line. Add 6 words for keyed address.

Wanted—The address of every gas and electric welder in the United States. Send them to Night Brothers, 113 S. Oakley St., Chicago, Illinois.

For Sale—Brand new Seneca A C electric welder machine at bargain. C. H. Dockson Company, 161 E. Columbia, Detroit, Michigan.

GENERATOR WANTED

We are in the market for a used Acetylene Generator with a capacity of about 100 pounds.

WEILER WELDING CO., DAYTON, OHIO.

For Sale—First welding works (gas and electric) in San Jose, established 1911. Doing good business. Small six-room house. Shop 40x48 on lot 50x180. All for $7,500. Half cash. Retiring from business. David Voss, 56 South Autumn St., San Jose, Calif.

Position Wanted—Electric and Acetylene welder with eight years' experience, mostly on railroad and locomotive work. Now located in Colorado. Willing to go anywhere for good steady position. Address 106, care The Welding Engineer.

Position Wanted—Electric welder with four years' experience wants steady job in neighborhood of Buffalo or Niagara Falls. Has operated G-E, U. S. L. and Lincoln machines. Good references. Address 107, care The Welding Engineer.

ALEXANDER MILBURN COMPANY
Baltimore, Md.

Have several excellent openings for thoroughly experienced salesmen of oxy-acetylene and kindred apparatus. Excellent opportunities and exclusive territories for able men.

Back Copies of The Welding Engineer For Sale—Have almost complete set of copies of The Welding Engineer since the first issue and will be glad to sell for reasonable price, purchaser to pay transportation charges. Address 108, care The Welding Engineer.

For Sale—Service rights on W. K. and W. C. Prest-O-Lite cylinders, large or small quantities. Alfred E. Corp, 40 Mathesson St., Providence, R. I.

Position Wanted—A-1 Oxy-Acetylene welder, ten years' experience, railroad and other industries, special skill in pipe welding, wants permanent position. Can furnish references. Address 109, care The Welding Engineer.

WELDING SUPPLY DEALERS

Do your customers know how best to use the apparatus you sell them? The best way you can serve them in this respect is to furnish them The Welding Engineer, and The Welding Encyclopedia. Write for our plan.

The Welding Engineer Dealers Service Dept.

608 S. Dearborn St., CHICAGO

Prepare the Work and Smooth the Welds with

MALL

Portable Electric and Flexible Shaft Tools and Grinders

MANY TYPES AND SIZES

MALL TOOL CO.

8385 S. Chicago Ave. Chicago, Ill.

Giving 99 7/10% Resistance To Time, Wear, and Abuse

During the past 15 years the Pressed Steel Tank Company has manufactured 70,000 Hackney "two-piece" acetylene cylinders, with block asbestos filler. Of this number, 69,800 or 99 7/10% are in active service today.

Records show that all of the 200 which are now out of use were destroyed by fire or some other external force. Only 2 of these cylinders actually ruptured. And they caused no damage—splitting down the side without fragmentation, and without leaving their original positions.

Records such as these show the true worth of Hackney Acetylene Cylinders. They give many years of continuous and trouble-free service. They stand up under the hardest usage. They are safe and dependable. And they offer 99 7/10% resistance to time, wear, and abuse.

With these things as a basis for consideration, it is easy to see why Hackney Acetylene Cylinders are the safest and most serviceable cylinders to be found on the market today.

Write for more detailed information.

PRESSED STEEL TANK COMPANY
MILWAUKEE, WISCONSIN

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Hackney
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Statler Hotel and Office Building, Boston, Mass.

Door Frames Manufactured by Peterson and Neville, Inc. Boston, Mass.

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From basement to roof, the new Statler Hotel in Boston represents the best in building construction. An inconspicuous but essential contribution to its perfection was made by the door frames manufactured by Peterson & Neville, Inc., and by the Wissco Welding Wire used in welding the trim and doors.

Wissco Welding Wire insures smoothness, strength and efficient application. Wissco saves gas consumption, waste of materials and welders' time.

You get no oxides, seams, impurities or hardness with

WISSCO WELDING WIRE

It is of homogeneous structure, without surface irregularities.

Better and more economical welds result from Wissco. Send for booklet describing different grades for each job.

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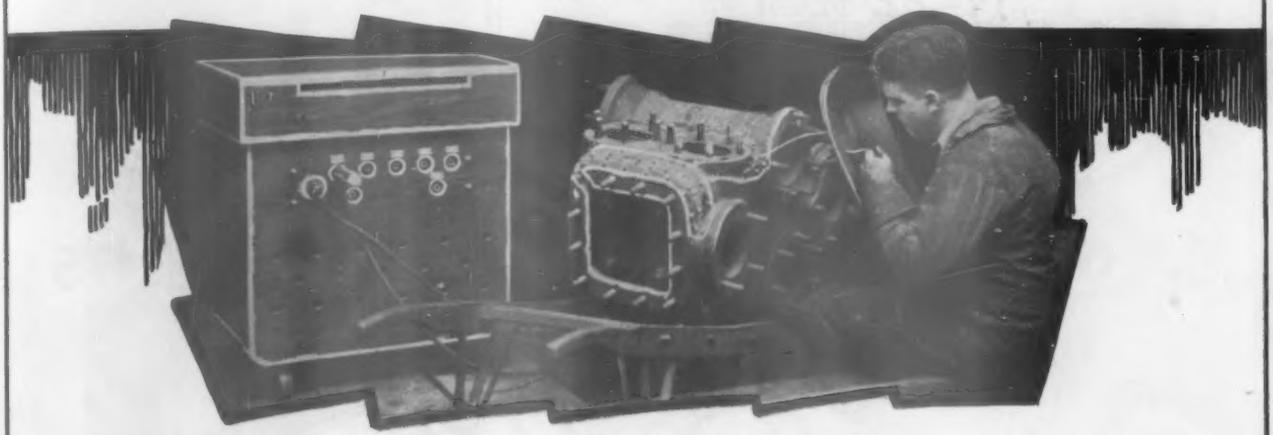
Please send me your booklet "Wissco Welding Wire."

Name ..... Address .....

WICKWIRE SPENCER PRODUCTS

WATERS ELECTRIC ARC WELDER

A DEPENDABLE MACHINE



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ELECTRODES FOR EVERY PURPOSE

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"ARE SO MUCH SUPERIOR"

writes an important user of the arc welding process:

Why? Because the C. H. Hollup Corporation devotes its entire time to the manufacture of welding wire and supplies. Because each member of the organization has made a life study of these products.

Hollup Welding Wire is not a side line but a specialized product, produced on a specialized plant by a specialized organization.

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Write for Samples

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№22 NEVER FLASH

A brand new addition to the Torchweld line

A LIGHT, perfectly balanced torch for average production and repair welding. One piece tips of graduated lengths to keep right distance from the work. Torchweld quality is maintained throughout, but you'll be surprised at the low price. Write for complete details of this new torch.

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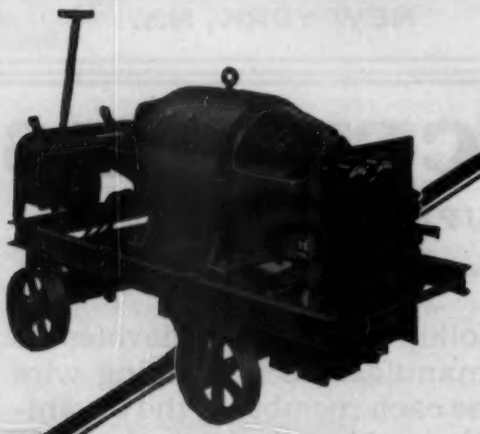
TORCHWELD

22NF TORCH COMPLETE AS SHOWN $25

Complete 22NF Unit Including 2 Regulators, Hose and Accessories $75

TORCHWELD QUALITY

One Torchweld user was recently persuaded to test another make of torch with a Torchweld. He found that his Torchweld equipment was saving 30% on gas alone. He sticks to Torchweld. That's what TORCHWELD QUALITY means.



Type A3—75 to 300 amps.
Type A4—100 to 450 amps.

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Is the way welding operators speak of the arc from their UNA Welders. There is a power and drive behind the arc that makes welding easy, plenty of heat for good penetration and welding speed. With a current range of 75 to 450 amperes a good welding operator has just what he wants, the right amount of current for every job from the thinnest sections to the heaviest structural steels and castings.

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A complete line of coated rods for both A. C. and D. C. arcs, for light and heavy duty welding, for copper, bronze, steel and cast iron.

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is uniform in quality throughout the same shipment and throughout all shipments. It is giving utmost satisfaction wherever used and is guaranteed to make perfect welds with the least amount of trouble in welding.

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The Grindle Electric Arc Welder gives the highest efficiency. When you get a GRINDLE you get satisfaction. It does its work perfectly, simply, and without expense.

There is nothing to wear out—nothing to burn out or to break.

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A PERFECT WELDER for the LOWEST PRICE EVER KNOWN.

$295

This efficient welding unit is adapted to both repair and production work. Current requirements of varying character are met by simple and easy adjustment of the switch.

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SENECA Electric ARC WELDER

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HIGH CARBON ELECTRODES FOR SURFACE TRACK WELDING
SIZES
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DEAD, SOFT ELECTRODES
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Your torch can tell the difference!

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Means pure acetylene.

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Means prompt service.

No matter what your gas requirements may be you will be interested in our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

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10 Welds in 10 Seconds

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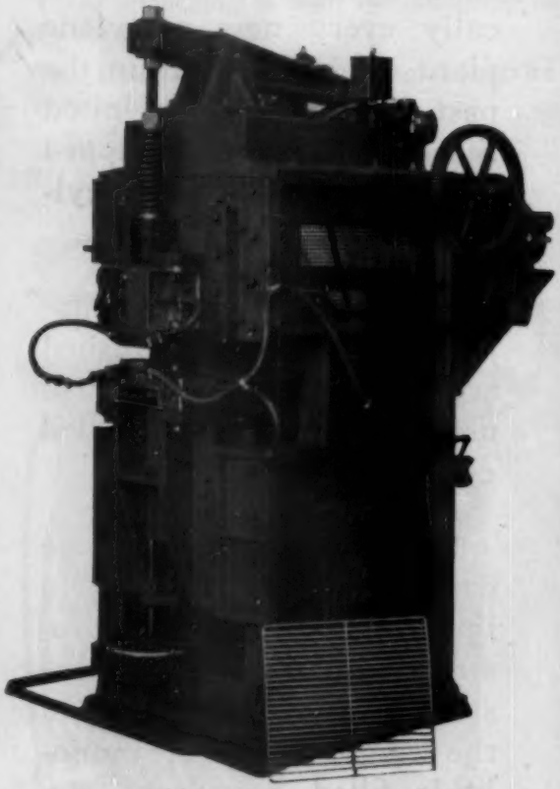

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WHENEVER we find special production problems we design special welding machines to fit them. If you think your work is "different", remember that our engineers have developed special welders for hundreds of "different" requirements. It is worth your while to investigate this service.

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Recognized leaders in the development and construction of all types of resistance welders.

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Made in all diameters, lengths and sizes.

Small diameter rods are sold in 4, 6 and 8 inch lengths, the shorter the rod the less breakage in shipping.

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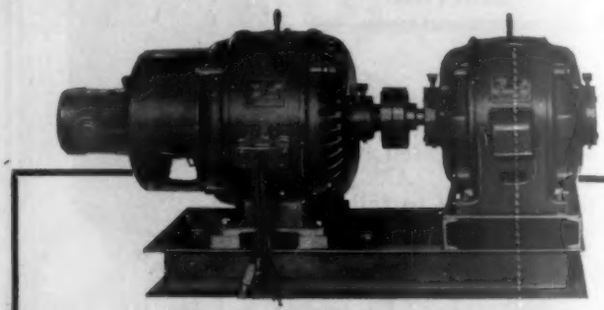

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Greater penetration means better welds at less cost, because both time and energy are saved. An exclusive feature of the HANSEN Arc Welder makes this possible. It has no external stabilizer. Let us explain how this will improve your plant operation.

NORTHWESTERN MFG. CO.
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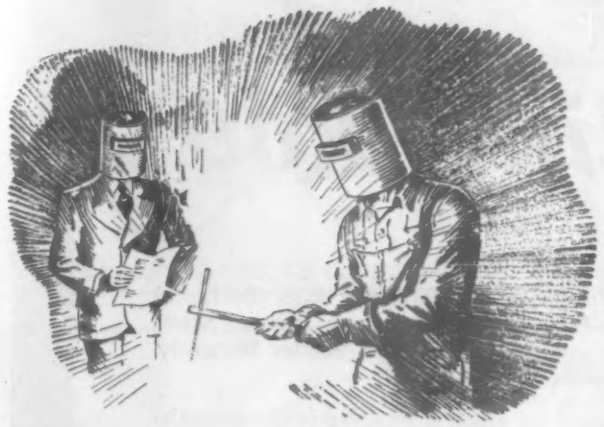
You be the judge..



make this test— *then decide!*

Volumes can be written about welding wire and electrodes—but the proof of quality lies in their adaptation to the work in your shop.

We believe that Page Steel and Page-Armco Welding Wire and Electrodes will assure you better welding at less cost—and we invite you to prove this for yourself. Write us today specifying the type of wire or rod you use and the work it is to be placed to—and we will send you sufficient material for a thorough test.

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Welding Wire *and* Electrodes

Imperial

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A Complete New Line of Oxy-Acetylene Welding *and* Cutting Equipment

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WELDENE is non porous.

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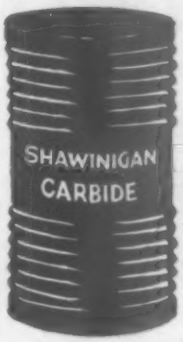
WHO ARE ITS MEMBERS?

The Secretary has a copy of the Membership Directory for you. Write for it.

If you dig into facts you will find



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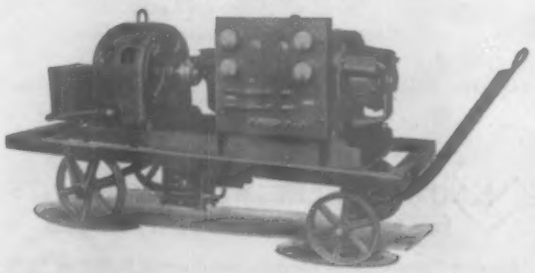

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Glass Replacement—

Simplest in any goggle. Nothing like it for ease and speed.

Glass—

Willson Industro Glass with protective cover glass.

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Indirect, yet highly effective. Keeps out all light. No open holes or slits to admit dirt and incandescent sparks.

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Manufacturers of goggles, respirators and welding helmets.

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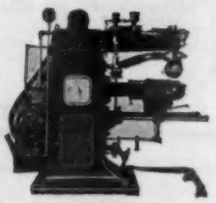

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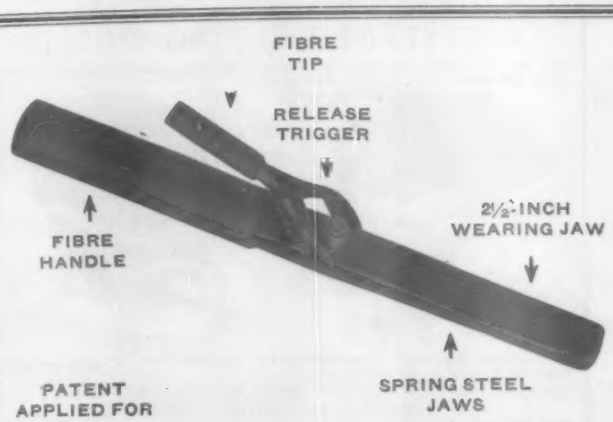

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Most Simple—Most Efficient—Metallic Electrode Holder Yet Developed.

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The WELDIT GASAVER
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GOODMAN ELECTRIC MACHINERY CO., 126 Green St., Newark, N. J.

for EYE Protection
IMMUNITE IMMUNIZES EYES
No Ultra Violet — Absolute Shade Values
No Infra Red — Scientifically Certified
STRAUSS & BUEGELEISEN
Front Street, BROOKLYN, N. Y.

ELKONITE

Draw Your Own Conclusions

The remarkable service that Elkonite Welding Electrodes give can best be appreciated by this plain comparison between Elkonite and the material that it replaced in a number of typical operations.

Operation	Previously Used Material	Elkonite
Radio panels	100 welds	8,000 welds
Brass radiator shells	16,000 welds	400,000 welds
Wire to heavy metal	300 welds	12,000 welds
Motor frame assembly	15 welds	400 welds
Wire to tin plate	50,000 welds	2,500,000 welds (incomplete)
Galvanized steel wire	15,000 welds	225,000 welds
Roller bearing assembly	24,000	400,000

Elkonite Welding Electrodes remain hard, *without mushrooming*, under red heat, great pressures and heavy electric currents.

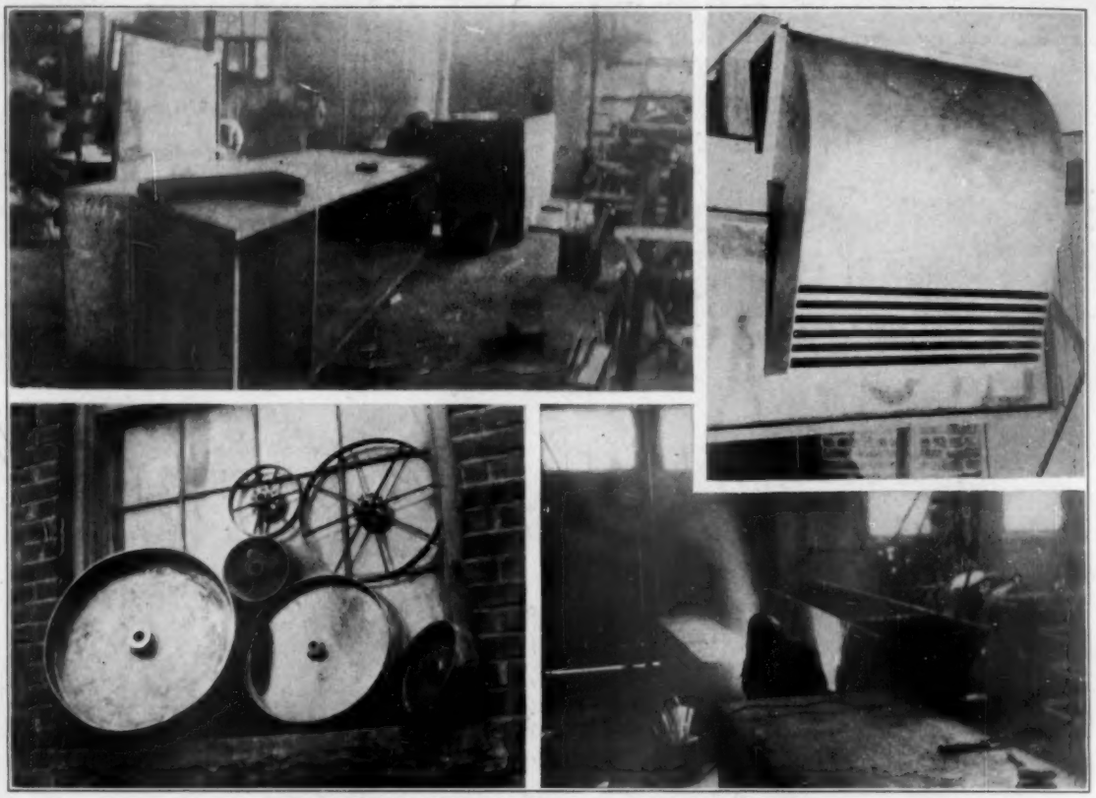
They have made the spot welding of brass, tinned iron, galvanized iron and aluminum commercially practicable.

Especially recommended for severe conditions such as hot upsetting rivets electrically, in facings for clamps for rod welding, split dies for welding steel spokes to both hub and rim of steel wheels, and all classes of flash welding.

WHEN HARD DRAWN COPPER FAILS
: : : YOU CAN DEPEND ON ELKONITE

ELKON WORKS Inc.
Subsidiary of P. R. Mallory & Co. Inc.
Weehawken, N. J.

Exclusive licensees under General Electric Co., patents dated May 28, 1925 and Sept. 1, 1925. Other patents pending to Elkon Works, Inc.



Our Apparatus Is in Constant Use on Jobs Like These

"Making Money for the Shop"

The owner of this shop says: "A ten-gauge all-welded tank to replace a riveted tank—using an Alternarc Welder, which is making me money." (Signed) C. O. Richardson.

Another Testimonial

From Granite Welding Co., Quincy, Mass.: "Last April I purchased one of your A-C. 110-v. welding outfits and am very well pleased with it. It has done wonderful work with very little cost (power cost). I have not used acetylene on anything since (except on copper, brass, etc.) because the arc is quicker, surer, and cheaper."

The Possibilities of
Structural Welding
and
Steel Tank Welding
with the
"ALTERNARC"
and
"DUALARC"

As the photographs above would indicate, there is no limit to the variety of sizes and shapes that can be welded with the electric arc. The finished job is better than previous methods and costs much less. These letters at left show that arc welding apparatus is a paying investment and remember that we supply apparatus for both A-C and D-C arc welding. No matter what your work may be we have the machine for it.

Electric Arc Cutting & Welding Co.

152-158 Jelliff Ave.,
NEWARK, N. J.
U. S. A.